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DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
George K. Burgess, Director

CIRCULAR OF THE BUREAU OF STANDARDS—No. 56

STANDARDS
FOR ELECTRIC SERVICE

[SECOND EDITION]

SEPTEMBER 26, 1923



PRICE, 60 CENTS

\$1.25 PER VOLUME ON SUBSCRIPTION

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STANDARDS FOR ELECTRIC SERVICE.

ABSTRACT.

The regulation of electric light and power service by State public utility commissions must be based on knowledge of the technical engineering factors entering into such service. Among these are station operation, distribution, metering, utilization, and provisions for safety. These factors are discussed, and on this basis a complete set of rules suitable for adoption by any State public utilities commission is presented. To show what has been done by commissions, all the rules now in force in the 22 States having such rules are given under suitable headings, alphabetically by States. Three ordinances, suited to the needs of cities of different sizes, from the smaller ones to the largest, are also proposed, together with a survey of present regulation by city ordinances.

Appendices summarize the laws of the States on electric service regulation and give tables showing results of meter testing, voltage regulation requirements, periodic testing schedules, and statistics on the development of the electrical industry. A selected bibliography concludes the circular.

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INTRODUCTION.

The regulation by State commissions of public-service utilities other than common carriers is becoming more widespread yearly. Not more than 15 years have elapsed since the first State commissions were created, yet regulation has already been established by law in greater or less degree in 40 or more States. It is now generally recognized that the supplying of electric service is naturally a monopoly, and should, therefore, be regulated by the State or by the municipality.

The intelligent and fair regulation of any utility requires a thorough knowledge of the elements that together constitute good service. It also requires a knowledge of what it is possible to supply at a given cost or what the increased cost will be if the service is improved in any particular respect. The Bureau of Standards has studied some of these questions with respect to gas service, telephone service, electric light and power service, and electric safety standards, and there has been great demand for its publications¹ on these subjects from the engineers and other representatives of the gas, telephone, and electrical industry, and from public service commissions, city officials, and the general public.

At present, 31 State commissions have adopted rules and recommendations for electric-service regulations which, however, vary considerably in their requirements. This makes it desirable to collect and compare the provisions of such State rules and to propose such standards as may be applicable generally.

Since the first edition of this circular was issued (July 28, 1916) a number of States have revised their rules of service, many of them in accordance with the suggestions made by the Bureau of Standards in the circular, and a new edition is now necessary in order to include the changes in State rules, and to bring the proposals made up to the present standards of accepted good practice.

A number of cities in States not having regulating commissions have established municipal commissions and inspection bureaus, while within the past few years in several States public utility laws have been changed, giving cities the power to regulate utilities

¹ Circular No. 32, Standards for Gas Service, 4th ed., Dec. 7, 1920; Handbook Series No. 3, National Electrical Safety Code, 3d ed., Oct. 31, 1920; Circular No. 112, Telephone Service, 1st ed., June 23, 1921; Circular No. 56, Standards for Electric Service, 1st ed., July 28, 1916.

where they operate wholly within any one municipality. The constitution or the laws of Arkansas, California, Illinois, and Louisiana give cities in these States regulatory powers under certain conditions.

The Bureau of Standards is cooperating with certain of these cities, as well as with State commissions, and has been a clearing house of information with reference to the important engineering questions of standards and accepted good practice.

The second edition of this circular presents a survey of the general field of State and municipal regulation in so far as standards of electric service are concerned, and suggests rules and regulations which may be adopted as proposed or which may form the basis for rules and ordinances to be adopted by States and cities.

Criticisms and suggestions on this circular are desired from all interested persons, especially from commissioners and engineers of commissions, public-utility operators and engineers, committees of technical societies, municipal commissions, municipalities, and operating companies. The bureau is ready to assist to the fullest extent in the establishment of standards and the promotion of a good understanding on technical engineering matters usually included in service rules between regulatory bodies, operators, and customers.

Acknowledgment is here made of the very cordial cooperation and assistance of commissions, committees of technical societies, municipalities, and utility organizations in the preparation and revision of this circular.

I. THE ADEQUACY AND SAFETY OF ELECTRIC SERVICE.

A. ELECTRIC SERVICE STANDARDS.

In many of the State laws establishing public-service commissions a very definite duty is imposed upon the commissions to require public utilities to "furnish safe, adequate, and proper service," or to furnish "such service and facilities as shall be safe and adequate and in all respects just and reasonable." In some cases the laws definitely state that utilities must not "provide or maintain any service that is unsafe, improper, or inadequate."

At the present time 40 States and the District of Columbia have laws to a greater or less degree providing for the regulation of service furnished by electrical corporations. Similar legislation has been considered in nearly all the other States. Under the laws so far enacted the States of Arizona, California, Colorado, Connecticut, Idaho, Illinois, Indiana, Iowa, Kansas, Maryland, Michigan, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Tennessee, Utah, South Carolina, Washington, West Virginia, Wisconsin, and the District of Columbia, through the public-service or railroad commissions, have adopted rules and regulations for the adequacy and safety of electric service. In Massachusetts the laws themselves specifically cover service standards, and no rules have been issued by authority of the regulating commission, as in other States. All State rules and regulations are listed on pages 44 to 215 of this circular.

The Board of Gas and Electric Light Commissioners of Massachusetts (established in 1884 and abolished in 1919 as a separate board, but all its functions included in the Department of Public Utilities) was the first body regulating public-service corporations not common carriers in the United States. The Railroad Commission of Wisconsin issued its first gas and electric service rules in 1908. As shown above, at this time (1923) in 30 States and in the District of Columbia electric utilities are required to conform to certain State-wide regulations as to standards of service. Public-service commissions in a number of other States are considering the adoption of service standards in accordance with the laws establishing and defining such commissions' powers.

The determination of what is safe, adequate, and proper electric service, in all respects just and reasonable, involves both engineering and economic questions, and a consideration of the relations which have developed in recent years between the public and the public utilities. Electric service, which is one of the important subjects of commission regulation to-day, had its origin about 40 years ago, and the apparatus and methods for the generation, transformation, distribution, measurement, and utilization of electrical energy have since been developed with wonderful rapidity and success. Engineering and commercial electrical associations, both national and local, have been formed in considerable numbers, and have large memberships and great influence.

According to the most recent report of the Bureau of the Census (Census of Electrical Industries, 1917, published in 1920) there were then 6,542 plants with 7,178,703 customers in 13,716 cities and towns, serving districts with a population of 62,919,662. The plants had a total capacity of 8,994,407 kilowatts, an annual output of 31,044,049,234 kilowatt hours, and were valued at \$3,060,-392,141.

The total number of customers served is given by the Census Bureau as 7,178,703. The total income of the 6,542 plants was \$526,894,240, while the total expenses, including salaries and wages, amounted to \$426,568,307. The total number of employees was 105,541.

By the time that the first public-service commissions were established in 1907-1909, the business of supplying electric light and power had become an important and widespread industry, and electric service in its economic and social aspects had become "clothed with a public interest." Public-service commission laws have, therefore, been made to include the regulation of electric service, and the establishment of service standards is made mandatory in many of the States.

In administering the provisions of the laws, in so far as they concern electric service, the public-service commissions have found that they have under their jurisdiction a great number of electric central stations in which the conditions of operation and facilities for furnishing service vary widely. In order that central stations may have a uniform standard of service, it is found necessary to allow some flexibility in the rules so that those utilities which are at times unable to meet all the requirements of the prescribed standards can be given reasonable time and oppor-

tunity to do so. Central stations are still operated in some communities under conditions which make it impracticable for the utility to meet all of the usual requirements of service standards. Under such circumstances suitable modifications and exceptions should be made.

In a number of the States the public-service commission law does not give the commission jurisdiction over municipally owned plants, but in Colorado, Indiana, Maine, Maryland, Missouri, Montana, Nevada, New Jersey, New York, Rhode Island, Utah, Vermont, West Virginia, Wisconsin, and Wyoming municipally owned utilities are under the jurisdiction of the commission.²

It would seem, however, that if the customers of municipal plants, being both the owners of the plant and the ones who benefit by proper service regulations, were to understand the advantages of proper service standards, such standards would be adopted either as State rules or municipal ordinances. As the rules proposed in this circular are just as suitable for municipally owned plants as for others it would seem to be a decided advantage to have them adopted and observed and thereby secure uniformity of practice. If they are deemed not to be suitable in any particular, the Bureau of Standards would be glad to be informed so that any objections or difficulties may be removed in later editions.³

The general principles underlying the adequacy and safety of electric service and the reasons for the various rules and provisions of ordinances suggested are briefly discussed in what follows.

B. FACTORS INFLUENCING ADEQUACY OF ELECTRIC SERVICE.

The adequacy, safety, and efficiency of electric service depend on many things and many conditions. Time and place, customs and convenience, and competition are general factors that must be considered in every case. Precisely the same service, in two different localities may be adequate and reasonable in one, but inadequate and unsatisfactory in the other.

There are in all electric services several general sets of conditions that very largely determine the adequacy and efficiency of any such service. These relate to: (1) Central-station operation, (2) the transmission and distribution system, and (3) the energy measuring and utilization devices. In addition, (4) the general

² See "Analysis of laws affecting municipally owned public utilities," prepared by the American City Government League, Brooklyn, N. Y.

³ On p. 267 and following are three ordinances, any one of which may serve as a starting point for service standards for municipally owned electric plants.

relations of the utility with the public are of great importance, and may have great influence on what the public in any given community may consider adequate and satisfactory service.⁴

The questions of voltage variations on lighting and power circuits, interruptions of service, frequency of alternation on alternating-current circuits, accuracy of watthour and other meters, and efficiency of lamps, motors, and other energy-utilization devices, are factors affecting the adequacy of service, each one of which depends to a certain degree upon the three general conditions above named.

Thus, for example, the constancy of voltage on a lighting circuit depends upon the prime movers—the engines, turbines, or water-wheels—of the station; upon the regulation of the electric generators; upon the distribution lines and transformers; and upon the wiring and character of load on the customer's premises. Furthermore, conditions of maximum load, time of use, the unbalancing of circuits, etc., have their part in determining the voltage supplied to apparatus on any line

These various factors will be considered under the general heads above named.

1. CENTRAL-STATION OPERATION.

It is not the purpose here to discuss in detail the problems of central-station operation, but it is desirable to call attention to certain phases and factors that affect service and may properly become the subject of investigation and regulation by State or municipal commissions. Enormous differences exist in the sizes of central stations, ranging from 100 kilowatts or less capacity in smaller towns to hundreds of thousands of kilowatts capacity in the largest cities. Only certain questions can here be touched upon, and they apply more particularly to the smaller stations, of which there are very many more than there are of large stations.⁵

(a) **Adequate Power and Generating Capacity.**—There are many central supply stations that have water-power plants with auxiliary sources of power, such as internal-combustion engines. In

⁴ The Railroad Commission of Wisconsin and the Illinois Commerce Commission have established systems of grading public utilities under their jurisdiction. Two papers, describing the procedure followed in Wisconsin and in Illinois, are contained in the report of the Conference of Public Utility Engineers, held at the Bureau of Standards March 2 and 3, 1923. See also *Electrical World*, 81, p. 1934; 1923.

⁵ Of the 6,542 central stations reported in 1917 (4,224 commercial plants, and 2,318 municipal plants), more than 5,000 were in communities of less than 5,000 people, while 2,221 were in localities of less than 1,000 population. There is, however, a strong tendency toward consolidation, and an interconnection of transmission lines.

many cases these engines are of insufficient capacity to carry the load during periods of low water, accident to water-power plant, or other emergency. Poor service due to low or fluctuating voltages is then the result.⁶

Central stations in the smaller towns at times find difficulty in supplying adequate service just at the time when most needed. Cases are not uncommon where householders must provide oil lamps and candles for emergency lighting; yet economic and commercial limitation may preclude better service.

Accidents may occur at any time to boilers, engines, turbines, generators, transformers, or distribution lines. Adequate and continuous service, so necessary to many industrial applications of electrical power, can hardly be given unless provision is made against emergencies. Stand-by units and duplicate lines are, therefore, important and should be provided when practicable.

(b) **Regulation of Generating Apparatus.**—The degree of uniformity of the service voltage of supply circuits is perhaps the main criterion by which the public judges the adequacy and general excellency of electric service. This is because the candlepower of incandescent lamps varies widely with voltage variations, and can be observed without test instruments or technical knowledge; also lamps are more extensively used than any other current-consuming device, so that their performance is apt to be used as a standard for judging the service furnished by any operating company.

A rather close voltage regulation is necessary in order to furnish satisfactory incandescent lighting service, although it is true that tungsten lamps are not so sensitive to voltage variations as were the old carbon lamps.⁷ Good inherent voltage regulation is very necessary in the generators used in the smaller

⁶ "It appears that the gasoline engine used by the utility as a stand-by in times of failure of the water-power equipment, is not large enough to carry the load * * *," Ill. Com. Com., No. 11097, July 20, 1921. "The plant in question is operated by a small water power and a 50-horsepower oil engine. The water power is not capable of carrying the heavier evening or peak loads, and it is, therefore, necessary for the engine to carry these loads. Attempts have been made to couple up the engines and water power but they were unsuccessful." Wis. R. R. Com., July 26, 1916.

"The complainant seeks to have the commission * * * require the defendant to furnish adequate electric service to the public * * * and to provide suitable machinery and appliances for that purpose. It is undisputed that the defendant's generating equipment is not sufficient to carry the full load on the plant." Mo. P. S. C., p. 208; 1921. "Electric service is inadequate when there is insufficient current to meet the demands during the early evening when street, commercial, and residential lighting is being furnished—it appearing that the lights are dim and unsteady—since adequate service involves both quantity and quality." * * * Mich. R. R. Com. D. 1023; 1917.

It is just as much the duty of the commission to allow a reasonable reduction in facilities shown to be in excess of the needs of the public as to order more service when it is shown to be inadequate. Ga. R. R. Com. File 8907. P. U. R. 1915 A, 901.

⁷ See p. 25 for tables showing effect of voltage variation.

central stations, but becomes of less importance as the size of the generating units is increased.

Regulation of voltage on constant potential supply circuits is one of the most important problems presented to the engineer who designs and develops a plant, as well as to the one who operates it. Efficiency in apparatus or transmission, even affecting, as it does, the cost of power, is in many ways secondary in importance to close voltage regulation. It affects directly the quality of the service and may appreciably reduce its commercial value. If unwarrantably great, it may result in unduly reduced candle-power or undue lamp breakage. It may adversely affect the speed, capacity, temperature, and starting torque of motors. In brief, it may cause an otherwise satisfactory service to become in these important respects unsatisfactory to the users and a burden to the apparatus employed.⁸

It is desirable to provide feeder voltage control for each individual feeder and regulate according to length and load and maintain the voltage at the station at such a value as to give the proper voltage at the feeding ends. It is not practical to regulate the station voltage so as to maintain constant voltage on all feeders unless they are of the same length and have the same load at the same time.

There are automatic generator voltage regulators on the market and in rather wide use which can be depended upon to keep the voltage fairly constant at the bus bars. Such regulators, however, are not more generally used, partly on account of initial cost for the smaller stations and largely on account of their inapplicability to stations having many feeders of varying lengths. Apparently less than 30 per cent of the smaller stations use them and very few, if any, of the larger stations.

(c) **Switchboard Instruments.**⁹—In early central station practice it was customary to use an incandescent lamp on the switchboard as an indicating voltmeter. The station operator regulated the voltage by observing whether this lamp was too bright, or too dim or about right. For many years, however, the switchboard voltmeter has been one of the most important of central-station instruments, and the quality of the service rendered by a station is very well indicated by such voltmeters. Graphic or curve draw-

⁸ *Electric Journal*, 5, p. 3 (1908).

⁹ See B. S. Circular No. 20, 2d ed.; also "Comparison of American direct-current switchboard voltmeters and ammeters," Fitch and Huber, *Bulletin B. & S.*, 7, p. 407, 1911, and "The accuracy of commercial electrical measurements," H. B. Brooks, *Trans. A. I. E. E.*, 39, pt. 2, p. 495; 1920.

ing voltmeters should also be installed, even in the smallest stations. They are especially valuable when conditions of voltage regulation are complained of by customers, and they are required by the rules of many State commissions.

Switchboard voltmeters are, of course, subject to errors and are apt to be incorrect unless properly maintained and calibrated on a periodic schedule. Alternating-current switchboard voltmeters seem to be more apt to read high than low though, of course, errors are liable to occur in either direction. (See N. E. L. A., 35th Convention, vol. 3, p. 364.)

A voltmeter that reads too high is a source of loss of revenue to the utility (that is, the energy output is less than it is thought to be), and if considerably in error, is likely to cause complaint from customers. A station voltmeter reading 1 per cent high, for example, causes a direct loss in revenue on lighting load of about 1.5 per cent, while the candlepower of tungsten lamps operated on such a circuit (that is, one actually 1 per cent low in voltage) will be decreased by about 3.5 per cent.

Voltmeters used with voltage transformers may give readings too low if care is not exercised to prevent the overloading of the voltage transformer. Voltmeters reading low tend to increase complaints of customers on lamps due to early failure caused by too high voltage.

Switchboard ammeters need not be discussed in this connection further than to call attention to errors that may be introduced by faulty connections between shunt and main circuits, between shunt and instruments on direct-current circuits, and by overloads on instrument transformers on alternating-current circuits. Large errors may be thus introduced and circuits overloaded and possibly damaged.

Ammeters and voltmeters are the most important indicating instruments on switchboards and are the only ones in many supply stations. In order, however, for utilities to comply with the requirements imposed by certain municipal and State commissions, indicating wattmeters and frequency meters are necessary. The New York Public Service Commission requires watthour meters to be installed in stations in addition to indicating wattmeters.

On alternating-current systems the product of volts and amperes as indicated by a voltmeter and ammeter is rarely the true measure of the power in a circuit. Systems operating at unity power factor are almost unknown. An instrument that will show the

true power is therefore necessary, and indicating wattmeters are thus desirable. A wattmeter in conjunction with a voltmeter and ammeter allows comparison of volt amperes and true watts, thus serving the purpose of a power-factor indicator.

Frequency meters are necessary in order to supply satisfactory service to the consumer and also to comply with the rules of certain States. It is highly desirable that a fairly constant frequency be maintained on all consumers' power services, since, with certain power-consuming devices used in various manufacturing establishments, it is important that the speed of such machines remain constant to insure satisfactory operation. The station operator is guided by the frequency meter in that it shows the constancy and accuracy of the speed of the generator. This is especially useful in the smaller water-power stations, where in many cases the speed of the prime mover is apt to be variable.

(d) **Station Records.**—Electric service to be adequate as defined by State commissions must be reliable, and interruptions must be kept down to a minimum. Many State commissions (see p. 119) require utilities to keep careful and complete records of all interruption to service. In the rules of Pennsylvania an interruption is defined "for purposes of record only as the interval of time during which the voltage falls below 50 per cent of the standard voltage," while in the Wisconsin rules an interruption is a "period of over 30 seconds during which the voltage on the circuit is less than 80 per cent of its normal value."

Undoubtedly records of interruptions,¹⁰ showing the time, duration, and cause of each interruption, make for better operation of the station and better service to the public.

Station logs¹¹ or records showing time of starting and stopping machines, time of turning street lights on and off, and readings of station instruments are rightly required by many of the rules adopted by regulating commissions. Where only all-night service or service from dusk to midnight is furnished, such records are especially important. Full, complete, and careful station records are of great value to the operating utility in rate and valuation cases, and no station is too small to keep a record of its operation,

¹⁰ The company furnished a list of interruptions affecting — from January 1, 1919, to date, which shows the duration, extent, and cause of the interruptions. A study of this record appears to indicate that the interruptions to service have been of such frequency and of such duration during the last two years as to be a just cause for complaint. Ill. P. S. Com. Decision No. 10818, Dec. 8, 1920.

¹¹ The keeping of a daily log sheet is of primary importance. Such a sheet should furnish a daily record of output for different classes of service and should also indicate the demands made upon the plant at frequent intervals. These data are essential if the utility professes to return a complete and adequate annual report to the commission. Wis. R. R. Com., 14, pp. 350 and 355.

even though but one man is employed for all work. The effect of such records is to cause the operator to run his plant carefully, not only because customers will be benefited but also because the records will stimulate the pride of the operator in his work and the plant.

2. DISTRIBUTION SYSTEMS.

The design and maintenance of the distribution lines and their auxiliary apparatus determine to a large extent the character of the service from the standpoints of continuity of service and good voltage regulation. Unavoidable losses always occur, but it is unfortunately not uncommon to find distribution systems so designed as to make the losses excessive and the distributing conductors themselves mechanically weak and more or less dangerous to life and property.

Many instances might be cited to show that inadequate and unsatisfactory service is due to unfamiliarity with what is good practice and a disregard for proper standards of good service.

(a) **Voltage Regulation of Feeders and Mains.**—The maintenance of constant voltage on distributing systems is of great importance and the failure to maintain constant voltage is one chief cause for complaint from consumers.¹² The voltage regulation of generators has been briefly referred to, but it is desirable to refer more specifically to the regulation of feeders, and primary and secondary mains.

The regulation of direct-current systems is most readily obtained by the interconnection of feeders and mains. These interconnections tend to relieve heavily loaded lines, by throwing the load partly on adjacent feeders in the same network. In other cases where larger differences in the loads or lengths of the lines exist, it often becomes necessary to operate several sets of bus bars, each at a different voltage, to which the distributing lines are connected, the longest lines to the busses of highest voltages. On the very largest systems motor boosters are used very successfully to meet the special conditions of a temporary nature.

On alternating-current distribution circuits good regulation is most readily accomplished by voltage or potential regulators,

¹² "The petitioners presented a number of witnesses, patrons of the respondent company, who testified as to the character of service rendered, claiming that by reason of low voltage, leakage, insufficient power, and other plant and maintenance defects, the electric lights were dim, at times flickering or flashing, and that frequently there were no lights; that the company failed and neglected because of inadequate plant and equipment to supply current for moderate power purposes on request." (Report P. U. Comm. Conn., 1913, p. lxx). "The question of regulation is very important. You know the man that comes in and kicks usually is not kicking so much on his bills as he is on his regulation." (Trans. A. I. E. E., 31, pt. 1, p. 489; 1912.)

either of the induction or step type. Induction regulators are made to be operated either by hand or automatically by motors, and can ordinarily be relied upon to maintain a substantially uniform voltage at all loads at the center of distribution. As the peak load will usually occur at different times on different feeders, and as the necessary amount of compensation (that is, increase or decrease of voltage) depends upon the load and the length of the feeder, it is evident that in many cases good regulation is only possible when each feeder is independently regulated.¹³

In laying out a new system or reconstructing an old one, the area to be served should be divided into districts and the maximum load for each district determined so as to keep the several feeders supplying these districts balanced as nearly as possible. The most economical cross section of copper should be used. That is, the cost of the conductor distributed over a period of time corresponding to the life of the feeder, should equal the cost of energy lost due to the drop. The value of feeder regulation must be taken into consideration, however, as it would not be possible to use the most economical sizes of conductors without some form of regulation, if the drop at maximum load is to be maintained within reasonable limits.

By providing proper voltage regulation, efficiency of operation will not stop at the bus bars, but will be carried through the consumer's apparatus. The cost of feeder-voltage regulation should be not charged alone to improved service, but also to the cost of reinforcing the conductors already in use as well as covering the loss of revenue due to voltage drop.

(b) Transformer and Secondary-Main Losses.—In addition to the voltage drop in feeders and primary mains there is a voltage drop in transformers and secondary mains. These voltage drops can not be compensated for by regulators, but must be taken care of by selection of transformers with good regulation, careful supervision of conditions of load on each transformer of the system, and the proper size of conductors for the secondary mains. Transformers sometimes become overloaded because of rapid growth

¹³ One particular advantage of the automatic regulator is that feeders may be more heavily loaded and yet perfectly satisfactory service is rendered, thereby making a great saving in the cost of reinforcing or primarily constructing extra heavy feeders, for without automatic feeder regulation it is necessary, in order to give satisfactory service, to have a wire of such size as to carry its maximum load with a very slight drop. We have had many cases where the installation of automatic regulators has saved us the cost of reinforcing the lines, while the cost of the regulator was only a very small fraction of the reinforcement. At the same time the average losses of the line were not excessive and would not justify a reinforcement when considered on the basis of all-day loss, but under peak conditions the losses were so excessive that the service was limited and the earning capacity of the feeder curtailed. (Jenks, *Electric Journal*, 11, p. 312; 1914.)

of individual customer's loads or of the number of customers to be supplied from one distributing point, and insufficient station records of transformer installations and their connected loads. It should be noted, too, that the regulation of transformers is dependent on the power factor of the load, and some transformers while giving good regulation on noninductive load may cause large voltage drop at full load on mixed motor and lighting load.

As it is well recognized in practice and in commission rules on voltage regulation that variation in voltage on distinctly power circuits may be much wider than on lighting circuits, this difference should be kept in mind in designing or rearranging a secondary distribution system. Circuits used primarily for lighting should be designed for a maximum voltage variation at the company's main-service terminals of not more than 5 per cent plus or minus from the standard average service voltage for any considerable time, while 10 per cent plus or minus may be allowed on power lines.

Commission rules now in force in some States allow only 3 per cent variation in voltage, but there is lack of sufficient evidence to show definitely whether or not utilities generally can comply with the rules adopted. Systematic voltage surveys are not available except in a few instances, but these seem to indicate that on mixed lighting and power service variations of 5 per cent are not uncommon even in the case of the very largest utilities and operating under commission rules. A 5 per cent plus or minus variation is therefore specified in the rules proposed in this circular, with a limitation that the total fluctuations from minimum to maximum shall not exceed 6 per cent of the nominal voltage in cities and other incorporated places having a population in excess of 2,500 people, nor 8 per cent in all other places.¹⁴

The size of wire to be used on the various parts of a distribution system depends on the voltage drop and power loss that can be allowed, taking into consideration the prospective increase in load. The size of the wires to be used on the various parts of the distribution system depends on the voltage drop and the current capacity of the copper, taking into consideration the prospective increase in load. The size of transformers and the extent of secondary distribution mains need special consideration, for it should be realized and understood that it will be highly economical to reduce the excess capacity of transformers over the contemporaneous maximum demand of all customers connected to the

¹⁴ In the appendix is given a table showing the allowable voltage variations specified in State rules. See p. 332. In the *Transactions A. I. E. E.*, 1920, 39, pt. 2, p. 1805, there is a paper by Reyneau and Seelye on an "Economic study of secondary distribution," which discusses this matter from a special viewpoint.

distribution mains; and, where large voltage drops occur, the cost of energy losses may also be excessive so that the fixed charges and operating charges may be greater than they would be with wires of larger size.

There are, of course, situations where close-voltage regulation is not economically possible. In suburban or rural districts or where service, if to be had at all, must be furnished directly from high-voltage transmission lines, wider voltage variations are justified than can be specified in any general commission rule. A reasonable rule, definitely stated, with exceptions made for specific cases, will improve service and in the end benefit both utility and customer.

(c) **Efficiency of Distribution.**—For purposes of complying with commission rules and regulations a knowledge of the efficiency of distribution—that is, the ratio of the energy sold at customers' service terminals to the energy delivered to the bus bars by the generators—is of importance.

Losses are of various kinds, such as line loss, transformer loss, meter loss and error, leakage, and unaccounted-for loss. On lighting systems the losses at full load will usually be from 15 to 25 per cent of the power supplied to the bus bar on the average alternating-current circuit. The total energy loss is made up of two parts—fixed losses, independent of the load, such as transformer-core loss and meter shunt loss, and the variable losses, depending on the load. Recent and reliable analyses of the distribution of losses do not appear to be available.¹⁵

A number of State commissions require careful records of station loads and output for purposes of proper accounting and report.¹⁶

¹⁵ Electrical World, 59, p. 947; 1912.

¹⁶ The Census Bureau's Central Electric Light and Power Stations, 1917 report (Table 56, p. 82) gives the following figures for distribution and line losses:

Total output.....	Kwh. 31,044,049,234
Distribution and line losses.....	4,460,610,487

This is approximately 14.4 per cent. The report says: "The absence of station meters and frequently of customers' meters, in addition to careless keeping of records and absence of engineering training on the part of some managers, has no doubt led to inaccuracy in specific cases * * *. Finally the accuracy of the line distribution and line losses will, of course, depend upon the care with which the output is measured at the stations and on the customers' premises. Whenever, as is frequently the case, in smaller plants, these data are largely estimates, some slight error will be unavoidable * * *."

Distribution losses as reported to Public Service Commissions.

	Year.	Total kwh.	Total losses in kwh.	Per cent loss.
District of Columbia.....	1920	136,787,425	34,502,619	25.3
Do.....	1919	112,128,360	29,054,980	25.8
California.....	1919	2,357,653,522	629,290,410	26.6
New York (1st Dist.).....	1917	1,280,755,111	255,425,301	19.9
Do.....	1916	1,146,310,504	223,655,879	19.5
Do.....	1915	989,359,588	210,579,249	21.3
New Hampshire.....	1920	.....	.....	20.0

The Wisconsin Railroad Commission says in a recent decision, "It is noted that the lost and unaccounted-for energy amounted to 39 per cent of that purchased. The normal loss for utilities of this size would probably be from 20 to 25 per cent." U.2458, June 30, 1921.

3. METERING.

Electrical measuring apparatus, for the purposes of this circular, may be divided into groups as follows:

1. Service meters, including watthour meters, amperehour meters, and demand meters, with accessory devices.

2. Switchboard and other station instruments, such as ammeters, voltmeters, wattmeters, station-watthour meters, frequency meters, power-factor meters, and recording instruments of various kinds.

3. Laboratory and testing instruments and meters, such as rotating standards (for example, portable watthour meters), precision voltmeters, ammeters, and wattmeters, standard cells, standard resistances, potentiometers, and other apparatus used for testing purposes.

It is suggested that uniformity and clearness in discussion will be gained if the term "instrument" be restricted to refer particularly to indicating and graphic devices; that is, to devices that indicate or record the present value of an electrical quantity at the time of observation or that make a permanent record of the variations of the quantity with time, and the term "meter" be used for devices which register through a totalizing mechanism the integral, with respect to time, of the electrical quantity to which they respond.

Watthour meters are still at times incorrectly called "wattmeters," "recording wattmeters," or "integrating wattmeters," and although the last can be defended, the term "watthour meter" should be used exclusively. "Wattmeter" and "recording wattmeter" are incorrect when energy measuring devices are meant, and should never be used in that sense, for the device is not recording and is not a wattmeter.

The terms "watts" and "kilowatts" (when watthours and kilowatthours are meant) are not uncommonly used incorrectly in ordinances and franchises still in force.

A recording instrument may be defined, as used in rules and ordinances in this circular, as an instrument which records graphically, upon time charts, the value of the quantity it measures. In

certain rules such instruments are called "graphic-recording" instruments, to call special attention to the curve-tracing or graph-making operation of the instrument.

(a) **Facilities for Meter Testing.**—Commission rules necessarily must be in general terms with reference to the meter-testing equipment and facilities of utilities inasmuch as they are applicable to the largest and smallest alike, unless special exceptions are made in the rules. Exceptions complicate the rules and it seems best to make rules with reference to meter-testing facilities sufficiently general to cover all cases, and have the commission inspect and approve each utility's equipment. Local conditions can in this way be taken care of to better advantage than by specific limits set in the rules themselves.

The distinctions ordinarily made between primary, secondary, and working or test standards are not in all cases clear and are apt to cause confusion. Utilities having so-called laboratory or precision instruments often think and speak of such instruments as primary standards. It seems desirable, therefore, not to refer in particular to primary and secondary standards in rules, but to make a general rule that each utility must have available such equipment, facilities, and apparatus as may be sufficient to carry out the provisions of rules, and to require approval by the commission as to the suitability and adequacy of the apparatus and instruments provided by any utility for its meter work.

The standards used in testing service watthour meters include voltmeters, ammeters, wattmeters, and portable watthour meters, commonly called rotating standards. The apparatus necessary and sufficient for each utility should be determined by the commission in each case. This allows for differences in local conditions and practice, and also gives the smaller utilities the benefit of engineering advice from the commission in an important matter.

The larger utility companies maintain standardizing laboratories, in many instances more fully equipped for precision work than some commission laboratories. In such cases definite approval of methods and apparatus and periodic inspection by the commission will insure proper service.

For the utility not maintaining what, in the judgment of the commission, is a "standardizing laboratory" a certain minimum of testing and checking apparatus should be definitely fixed by service rules.

(b) **Accuracy Requirements for Watthour Meters.**—Commission rules and city ordinances should definitely state to what degree of

accuracy watthour meters should be adjusted when installed or after test. It is possible to adjust meters to within 1 per cent both at light load and at heavy load, although it may be difficult to obtain so high a degree of accuracy under certain service conditions. An adjustment to within 2 per cent plus or minus at both light and heavy load is, however, entirely practicable, and, of course, closer adjustment should always be attempted.

Meters having errors in registration not in excess of 4 per cent to the prejudice of the customer are declared to be legally correct meters in most State laws, commission rules, and city ordinances, although the method of determining the error is by no means definitely or satisfactorily stated. Even in State rules there is considerable ambiguity, as may be seen in Table 1 in the Appendix (see p. 327).

The error of a watthour meter is, in general, different at light load from what it is at heavy load, and may have still other values at intermediate loads. The determination of the average error of a watthour meter, and particularly its expression as a definite single value is not a simple matter, as it involves both technical and commercial considerations. It is necessary, however, to specify a definite method for its determination, so as to provide a predetermined basis for the settlement of questions which may arise as to fast and slow meters. Two methods are at present in use—a 2-point method, which considers the average of the errors at light load and at heavy load to be the average error of a meter; and the 3-point method, which, in addition to finding the error at light and at heavy load, finds the error at normal load and gives this a weight of 3 in computing the average error.

The Code for Electricity Meters recommends the following procedure for the 3-point method (Sec. VII, B 21, p. 99):

For the determination of the average percentage of accuracy the following rule is recommended as an equitable method.

(a) All meters, whenever possible, shall be tested at three loads; one-tenth of the full-rated capacity of the meter, normal load, and full-rated capacity of the meter.

(b) The average of these tests, obtained by multiplying the result of the test at normal load by three, adding the result of the tests at one-tenth capacity and full capacity and dividing the total by five, shall be deemed the condition of the meter.

(c) In an installation where it is impossible to obtain a load of 10 per cent of the rated capacity, or 100 per cent of the rated capacity of the meter, tests shall be made at the nearest obtainable loads to 10 per cent and 100 per cent of the rated capacity of the meter and the value given in the ratios as stated above.

(d) The following classification, in percentage of installation, shall be used in determining normal test load:

Classification of installation to be used in testing meters at normal load.

	Per cent.
A. Residence and apartment lighting.....	25
B. Elevator service.....	40
C. Factories (individual drive), churches, and offices.....	45
D. Factories (shaft drive), theaters, clubs, entrances, hallways, and general store lighting.....	60
E. Saloons, restaurants, pumps, air compressors, ice machines, and moving-picture theaters.....	70
F. Sign and window lighting and blowers.....	100

(e) When a meter is connected to an installation consisting of two or more of the above classes of loads, the normal load must be obtained by adding the normal loads in kilowatts of the parts of the installation corresponding to the various classes.

Practice and opinion among central-station operators differ with respect to this question, and this difference of opinion is reflected in existing commission rules. Sufficient comparative facts are not at hand to determine the difference, if any, between results as determined by the two methods. Both methods are, therefore, suggested in the rules and ordinances in this circular. The selection of the method ¹⁷ to be used in any State's rules or city's ordinances should be made after careful consideration of State-wide or local practice.

(c) **Installation and Testing of Meters.**—Proper and careful installation of meters in some uniform manner adapted to various types of meters and to different conditions of service is very desirable, in order that the maximum convenience to meter reader and tester be afforded with the minimum inconvenience to the customer. Installations must also be such as to insure safety and continuity of service.

In accepted good meter practice meters are placed in the cellar or first floor, or as near as possible to the service, in a clean, dry, safe place, free from vibration and magnetic disturbances. In many instances, however, the service wires enter buildings through attics, and many companies find it necessary to install meters in attics for this reason. Apartment houses, office, and loft buildings represent types of buildings where meters are best located in banked installations in basements, where possible. Meters should not be installed in bathrooms, bedrooms, clothes closets, kitchens, coal bins, over doors, over windows, or in any location

¹⁷ The 3-point method is specified in the rules of Connecticut, Maryland, New Jersey, and New York, while the 2-point method is adopted in Colorado, Illinois, Michigan, Missouri, Oklahoma, Pennsylvania, and West Virginia.

where the visits of the meter reader or tester may cause annoyance, or where the meter itself may suffer damage, unless such installation is unavoidable in order to furnish service.

Where two or more meters are installed on the same meter board, or in close proximity to one another, the distance between centers should not be less than 15 inches for direct-current meters, and 10 inches for alternating-current meters. Where several meters are thus grouped together, the various service circuits should be plainly marked or tagged. Much annoyance and even danger to meter testers and customers may be avoided by such tagging of circuits. Although this is a matter primarily for the wiring contractor, and is usually required by the municipal wiring rules, there are many installations where the utility may find it advantageous to mark circuits for the convenience of its meter testers and customers.

In general, the place of location of meters is a special problem to be worked out by each utility, keeping in mind the general principles here mentioned.

Installation tests are required by most commission regulations, and should be made whether required by rules or not, at least on all direct-current installations. The following table ¹⁸ shows results obtained on 2,500 commutator meters used on direct-current circuits. The results are obtained from several companies and are averages from installation tests. They indicate clearly the necessity for installation testing for commutator meters.

Test load.	Percentage of total number not registering.	Percentage of total over 4 per cent fast.	Percentage of total over 4 per cent slow.	Percentage of total correct between—	
				96 to 104 per cent.	98 to 102 per cent.
Heavy.....	0.2	2.0	6.0	92.0	70.0
Light.....	1.0	15.0	25.0	60.0	40.0

It has been estimated that the smaller companies have installed about 1.4 kilowatts of meter capacity for each kilowatt of generator capacity. It has also been shown, in the case of one of the largest utilities, that of the total plant investment for the alternating-current system 25 per cent is for generating equipment and 17

¹⁸ Report of National Electric Light Association, Thirty-fourth Convention, 2, p. 235; 1911.

per cent for meters. The generating investment for a residence customer is 26 per cent and the meter investment 18 per cent. From the investment standpoint it is seen that as careful maintenance of meters is demanded as for generators. Although the accuracy of meters is a question in which all customers are concerned, there are cases reported of central-station operators paying so little attention to meters that they confessedly did not know that there is anything about a meter that is adjustable.

No service can be considered adequate in which reasonable effort is not made to install reliable meters and maintain them accurate by periodic inspection and adjustment.¹⁹

A system of carefully kept records seems essential, even in the case of the very small utility, for the proper supervision and maintenance of meter installations. Meter records should be kept for all meters owned by a utility, such record for each meter to begin when the meter is purchased and to be continued until the meter is scrapped or otherwise permanently removed from service. This record should cover at least the following items: (a) An identifying serial number, and all electrical characteristics of the meter, such as rated capacity, meter constant, two or three wire, alternating current or direct current, etc.; (b) meter location with dates of purchase, installation, and removal; and (c) dates of tests made and tests due, with results of such tests. Practice differs as to the number of cards used for each meter for keeping records and as to the time other than property records are kept.

4. CUSTOMERS' UTILIZATION DEVICES.

(a) *Incandescent Lamps.*—It is reported²⁰ that during 1922 approximately 200,000,000 tungsten filament incandescent lamps and 3,000,000 carbon filament lamps were sold. This is an increase of about 25 per cent over 1921 sales for tungsten lamps, but a decrease of 50 per cent in carbon lamps sales. The carbon lamp is rapidly disappearing from the market.

¹⁹ The small companies, as you know very well, have no outfit for repairing and testing meters, and they are brought right to the test board, where we are able to ascertain the conditions they are in. One of the towns in western Ontario recently, which had been in default with regard to their meter inspection, was told that unless they complied with the law, we should have to put them into court. The meters had gone seven or eight years without testing and so they were brought in. A large number of them were found to be quite slow, certainly below the limit allowed in the act, and some months after the test had taken place, we received a very complimentary letter from the company, thanking us for insisting on their bringing in the meters, as their revenue had increased considerably since that time [laughter]. (Proceedings Canadian Electrical Association, 1921, 31st year, p. 32.)

²⁰ Report lamp committee, National Electric Light Association, New York meeting, 1923.

The incandescent lamp is the one type of electrical apparatus with which nearly everyone is to a certain extent familiar, and by which the adequacy of the electric service is most commonly and readily judged by customers of electric-supply companies.

With the exception of a relatively small number of lamps made for series burning for street lighting and street railway service, all incandescent lamps are designed for operation in multiple on constant-voltage circuits. During recent years there have been many changes made in the design and construction of tungsten filament lamps, all of which have tended to produce stronger or more efficient lamps, and to adapt them to all conditions of service.

The candlepower of a lamp is to-day used as a distinguishing name only in connection with street-lighting lamps intended for series operation on constant-current circuits. Instead of candlepower, the watts, in connection with a voltage rating, serve to distinguish lamps universally in the trade, and lamps are rated by manufacturers in watts and volts. An incandescent lamp is rated and labeled according to "its size"; that is, initial total watts and the voltage of the circuit on which it is designed to operate.

If the voltage of the circuit is less than the rated voltage of the lamp operated on it, the watts consumed, the resultant candlepower, and efficiency are all less than at rated (that is, labeled) voltage. On the other hand, a lamp operated on a circuit of higher voltage than that indicated on the label of the lamp, consumes more energy, gives a greater candlepower, and has a higher efficiency but a shorter life than when operated at rated voltage. The word candlepower is falling into disuse, being replaced by the "lumen," which is the unit of luminous flux and a measure of the total light produced by a lamp. The efficiency of an incandescent lamp is the ratio of the luminous flux output to the power input, usually expressed as "lumens per watt."

VOLTAGE AND FREQUENCY EFFECTS.—Lumens, watt consumption, efficiency, and life of a lamp all depend upon the applied operating voltage, the life changing much more rapidly with voltage than do candlepower and efficiency. Adequate lighting service is ultimately dependent then upon two things—a very nearly constant uninterrupted voltage supply and a lamp adapted to such voltage supply. The cost of this lighting service is, in turn, dependent upon such factors as the cost of electrical energy, initial and renewal costs of the lamp, and average efficiency of

the lamp. Other additional factors need not be considered here. A life of 1,000 hours for tungsten lamps has been generally agreed upon by manufacturers and the central supply stations, and tungsten lamps are rated and labeled so as to give this life on the average when operated at labeled voltage.²¹

Attention has already been directed to the variations produced in the operation of incandescent lamps caused by variations in the applied voltage. The following table shows clearly the large differences in lumens, power consumption, and life made by voltage changes, in steps of 1 per cent.

TABLE A.—Effect of Voltage Variations on Tungsten Filament (or Mazda) Lamps.²²

Volts.	Candle-power or lumens.	Total watts.	Lumens per watt.	Current.	Life.
Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
95	83.1	92.2	90.1	97.0	208
96	86.3	93.7	92.1	97.6	178
97	89.6	95.3	94.0	98.2	154
98	93.0	96.9	96.0	98.9	133
99	96.4	98.4	98.0	99.4	115
100	100.0	100.0	100.0	100.0	100
101	103.6	101.6	102.0	100.6	88
102	107.4	103.2	104.1	101.2	76
103	111.2	104.8	106.2	101.8	66
104	115.1	106.4	108.2	102.3	58
105	119.0	108.0	110.1	102.8	51
110	140.3	116.3	120.6	105.7	27

This table shows that large variations in incandescent lamps are caused by voltage variations, and indicates the necessity of close voltage regulation for adequate and economical lighting service. Voltage fluctuations exceeding from 3 to 5 per cent are evidently too great to give satisfactory service. Operation of lamps at lower voltage than that for which they are designed, not only tends to decrease the utility's revenue and produce less candle-power but it actually increases the cost of lighting per lumen-hour to the customer. On the other hand, operation at higher voltage increases the candlepower of the lamp, decreases the life, and

²¹ See B. S. Circular No. 13, 10th ed., U. S. Government Specifications for Large Tungsten Filament Incandescent Electric Lamps, 1923. Federal Specifications Board, Standard Specification No. 23.

²² See B. S. Sci. Paper No. 238, Characteristic Equations of Tungsten Filament Lamps, Middlekauff and Skogland, 1914.

increases the cost of lamp renewals. Close regulation is advantageous alike to central station and customer.²³

Frequencies of 60 cycles per second are satisfactory for all types of incandescent lamps. On 25-cycle circuits tungsten lamps of smaller sizes, such as 10, 15, 25, and 40 watts, operating at 110 volts and over, flicker perceptibly. Lamps of higher than 40 watts capacity operated at 110 volts do not flicker seriously on 25-cycle circuits.

Lamp life varies largely with changes in efficiency. Table "A" indicates that small differences in efficiency of lamps result in large differences in lamp life. For example, a difference of 10 per cent in the efficiency of tungsten filament lamps will result, roughly, in doubling or halving the life of the lamps.

Specifications for incandescent lamps issued by the Bureau of Standards and known as "United States Government specifications for large tungsten filament incandescent electric lamps," Standard Specification No. 23 of the Federal Specification Board, have been generally accepted by the lamp industry. There are, however, lamps on the market of efficiencies so little below the generally accepted standard as to avoid notice, but sufficiently below that standard to compensate for what would be too short life at standard efficiencies. Correctness of lamp rating and of lamp performance can only be judged by test of conformity to the

²³ Report lamp committee, National Electric Light Association, Philadelphia meeting 1914, commercial volume, p. 122:

"There can be no economy and there is an actual loss to the consumer and to the central station company on operating lamps under the voltage for which they are intended, and a reasonable amount of attention to securing lamps of proper voltage for the circuits on which they are to be operated will conserve the interests of member companies, and improve the service rendered to customers.

"The table herewith presented will be interesting in this connection, showing, as it does, the variations in total watts and candlepower of the rated values due to variations in voltage above and below the rated, also the variations in total cost of light, including energy and cost of lamp renewals. For instance, a 112-volt, 100-watt lamp, if operated at 109 volts (98 per cent), would have a capacity of 96.9 per cent in watts and 93.2 per cent in candlepower and would cost for a given illumination 102.3 per cent, as compared with 100 per cent for all these values at 112 volts."

Cost based on list price of 60-watt Mazda lamps and current at 10 cents per kw.hr.

Per cent of rated lamp voltage.	Per cent watts.	Per cent candlepower.	Per cent of total cost of light at rated lamp voltage.
96	93.7	86.7	105.1
97	95.3	89.9	103.7
98	96.9	93.2	102.3
99	98.4	96.5	100.9
100	100.0	100.0	100.0
101	101.6	103.5	99.1
102	103.2	107.2	98.1
103	104.8	110.8	97.3
104	106.4	114.6	96.7

specifications referred to. Many large purchasers of incandescent lamps find it advantageous to follow this procedure.

SUPERVISION OF LIGHTING SERVICE.—Continuity of service, good voltage regulation, and reliable meters carefully maintained are very important factors in determining good lighting service and thereby making satisfied customers. In addition to these, however, a few State commissions require utilities to make periodic inspections of the lighting installations of their customers, especially when free lamp renewals are furnished by the utility.

While poorly designed lighting fixtures improperly located and supplied with more or less blackened lamps are unfortunately still not uncommon, there is a decided tendency on the part of customers to install new fixtures, providing more improved methods of lighting. An improvement in the appearance of the fixtures naturally results in the customer's desire to keep cleaner and more efficient lamps in service.

The questions of commercial policy involved in the determination of what may be the most satisfactory method to the public and to the utility companies in the matter of handling lamps required by the customer's installation present a problem of considerable complexity. The great progress made in the manufacture of incandescent lamps, resulting in a rapid increase of lamp efficiencies and decrease in the prices of lamps, and the requirements of the public-service commission laws in a number of States, conferring in some cases specific authority on the commission "to fix the initial efficiency of electric lamps furnished by electric companies,"²⁴ or "to prescribe from time to time the efficiency of the electric-supply system, of the current supplied, and of the lamps furnished by the persons or corporations generating and selling electric current,"²⁵ both tend to complicate the situation and make it extremely difficult to say what service standards should be recommended. The electric service rules of the commissions in Colorado, Indiana, Maryland, Michigan, New Jersey, North Dakota, Oklahoma, and West Virginia cover the question of the efficiency of incandescent lamps furnished as free renewals in a general way by specifying that the lamps furnished without charge to consumers should be of such efficiency that the con-

²⁴ Connecticut.

²⁵ District of Columbia, Maryland, Missouri, and New York.

sumers may obtain lighting service under the most favorable condition practicable under the given rate schedule.²⁶

These rules conform with the fundamental justification of the free lamp renewal practice, which is the opportunity it affords for supplying to the public lamps that will serve them most efficiently and satisfactorily. Where carbon or metallized filament lamps are still being supplied as free renewals, the practice is apparently being continued either through inertia or on account of franchise or other municipal regulations.²⁷

Those companies which are pursuing the most progressive policy in these matters are furnishing tungsten lamps as renewals to a very large extent, and as the high-efficiency tungsten lamp is usually the most economical lamp for the customer to use, every effort should be made by central-station companies to bring to the attention of their customers the advantage of using lamps of as high an efficiency as may be practicable under given service conditions.

Where lamps are supplied within the price charged for electrical energy on the "free-renewal" basis, they are, of course, paid for by the customer, as the rates cover the renewal cost to the utility company. With the present lamp efficiencies and at present prices, tungsten lamps, at any rate in the larger sizes, can be furnished to customers at the same or less renewal cost to the central stations than carbon or gem lamps.

A well-known central station manager has well said:

The central station is interested in securing to its customers the highest standard of lighting service at the lowest practicable rates, and its commercial success and prosperity depend primarily on the excellence of its service. In maintaining a high standard of service the lamp itself is a factor of first importance. The central station does not aim to make the supply of incandescent lamps to its customers a source of profit; it seeks merely to cover its expenses in connection with the supply and handling of the lamps, and the better the quality of the lamps and the more cheaply it can supply them the greater the extent to which its ultimate aims are realized.

If this is a fair statement of the policy of central stations in the matter of lamp renewals, they should make every effort to induce their customers to use lamps of higher efficiency.

The following statement presents correctly the argument for "free lamp renewals," and in order to provide an efficient lamp

²⁶ The Public Service Commission, First District New York, in 1915 issued orders relative to the efficiency of incandescent lamps furnished by the operating companies of Greater New York. Annual report, I, 1915, pp. 556, 559, and I, 1916, p. 444. See also Calif. R. R. Com. Decision 6000, Dec. 21, 1918, recommending that free carbon lamp service be discontinued on the ground that the cost of lighting service was greater than if the consumers purchased higher efficiency lamps.

²⁷ According to the "N. E. L. A. Rate Book, 1923," in only 10 cities are carbon or metallized filament (gem) lamps being furnished as free renewals.

renewal service it involves a certain supervision by the central station over the customer's lighting installation:

If the central station makes lamps available to customers freely, a high lighting standard is maintained and the lighting service is satisfactory and attractive. Sockets are kept filled, lamps of uniform brilliancy are maintained, old and dim lamps are removed from the circuits, and the extensive use of light is encouraged.

(b) *Motors.*—Induction motors are at times operated on circuits of different voltage or frequency from that for which the motors are rated. Under such conditions the performance of the motors will vary from standard conditions of efficiency. Voltage variations of 10 per cent on power circuits are allowed in most commission rules. The following is a brief statement of some operating results caused by 10 per cent voltage variations, and is indicative of the general type of changes produced in operating conditions by such voltage variations.

Operation at 10 per cent overvoltage causes a small increase in speed (about 1 per cent), increases the starting and pull-out torque approximately 20 per cent, increases the efficiency approximately 0.4 per cent, but lowers the power factor. The primary and secondary copper losses are slightly decreased and the core loss increased roughly 9 per cent, while in a well-designed motor the heating is about the same. In general, operation at 10 per cent overvoltage and at normal load is entirely satisfactory, but at any load less than normal the efficiency is decreased. Overvoltage of more than 10 per cent will make wider variations in operation characteristics, and will result in greatly reduced power factor and prevent cool operation.

Operation at undervoltage of about 10 per cent decreases the starting and pull-out torque approximately 20 per cent and the efficiency at normal load approximately 0.6 per cent, but improves the power factor. The primary and secondary copper losses are increased and the core loss decreased so that the heating is approximately the same and the operation, in general, is satisfactory. If further reductions in voltage are made the efficiency is greatly reduced, as well as the power output, and the heating becomes excessive.

Higher than rated frequency improves the power factor, but decreases starting torque, and increases the speed, friction, and windage. At lower than rated frequency, the speed is, of course, decreased; starting torque is increased; and power factor slightly decreased. For certain kinds of motor load, such as in textile mills, close-frequency regulation is essential.

(c) **Heating and Other Devices.**—During recent years a very great increase in the use of heating devices has taken place. Though it is well known to many users of incandescent lamps that proper voltage conditions are necessary for satisfactory lighting service (dim lamps or excessively bright lamps are easily seen), it is not so well known that satisfactory operation of heating devices is also largely dependent on voltage regulation.

The voltage rating of heating appliances has been fixed to close limits, and most manufacturers have set definite limits on the voltage beyond which satisfactory operation can not be expected. This range is usually about 3.5 volts from a fixed standard. Flatirons, warming pads and pans, curling irons, etc., do not need quite so close limits as do cooking devices. A low voltage applied to a cooking device is very unsatisfactory, because of the excessive time required to bring the device to the proper temperature, and successful operation is made difficult. Economical operation of cooking appliances depends to a very large degree upon the time required for the appliance to reach a certain temperature, and this in turn depends upon the voltage.

5. RELATIONS WITH THE PUBLIC.

The subject of relations with the public, considered as an element or factor in the quality of service furnished, can only be referred to briefly.

(a) **Information to the User and Prospective Customer.**—Numerous decisions of commissions and the requirements of rules now in force cover the points on which the user or prospective customer should receive information from the utility. Many customers of electric-service companies are entirely unfamiliar with the simplest facts of electrical engineering, and do not understand that distribution may be either by direct current or alternating current, that an electric meter must be adapted to the type of distribution and the voltage, or that an automobile starting battery can not be charged directly from an alternating-current circuit.

Rules covering the reading of meters and suggesting that the utility make an effort to inform its customers how meters are read, render bills in as simple form as possible, and furnish information as to type of service are, therefore, proposed.

(b) **Deposits, Discounts, and Penalties.**—Commission decisions generally have upheld the practice of many operating companies in demanding deposits from customers, whose credit may not

have been clearly established, for the protection of the company against bad debts and consequent increased cost to the customers. Interest on such deposits should, of course, be paid, and facilities provided for the refund of deposits under reasonable and fair regulations.

There is much diversity of opinion among operating companies and in commission decisions on the question of discounts for payment within a specified interval versus penalties for nonpayment within such an interval. Payments by the 10th or 15th day of the month following, with either a discount or penalty clause, are very commonly required in contracts for electric service, but no commission has apparently issued a general rule or regulation on this practice. It appears, however, that the practice of some utilities of rendering bills continuously throughout the month and requiring payment within 10 days, after which a penalty of from 5 to 15 per cent is assessed, needs careful explanation on the part of the utility, for the practice undoubtedly causes dissatisfaction on the part of many customers. Grocers, department stores, and tradesmen generally render bills at the end of each month, and to receive a bill for electric service on the 20th of the month, payable on or before the 30th, with a penalty of 10 per cent if the bill is paid on the first or second of the succeeding month, needs to be explained to the householder.

(c) **Extensions.**—No subject causes more controversy than the practice of a utility as to extensions. A few commissions have issued detailed rules and regulations but it is considered best, everything considered, to make the rule for extensions very simple, requiring, however, that each utility have a definitely known and announced policy filed with the commission so that when controversy does arise each case can be treated by the commission on its merits solely and in line with local conditions and requirements for each locality and utility.

C. SAFETY OF ELECTRIC SERVICE.

1. GENERAL STATEMENT.

The public service and industrial commission laws in many States provide that electric service shall not only be *adequate* but also *safe*, and in 20 or more States certain regulations governing safety requirements have been issued either by the public service or by an industrial commission. In some States certain safety provisions are incorporated in the service rules issued by

the commission (see pp. 107, 123), and in a few States a statute prescribes standards of construction and maintenance of overhead and underground installations.

The general questions of safety in the operation of electric utilities as well as line construction are covered in great detail in the "National Electrical Safety Code," Bureau of Standards Handbook Series No. 3 (1921), while Handbook No. 4, "Discussion of the National Electrical Safety Code" (1921), is an exhaustive treatment with engineering data and tables of the principles underlying the rules of the code.

A list of all rules adopted, covering both service and safety, is given on pages 44-51 of this circular.

In electrical systems employing high potentials there is more or less danger to life from shock, and the protection both of the employee and the customer against the dangers incident to the use of such potentials is an essential element of safe, proper, and adequate service, and every reasonable effort should be made to secure this protection.

In the service rules suggested for State regulation a few rules covering safety requirements are included, for the reason that certain requirements with reference to safety are a necessary part of service rules. These rules apply particularly to the grounding of low-potential circuits entering customers' premises and the inspection of apparatus of various kinds.

2. GROUNDING LOW-POTENTIAL CIRCUITS.

The use of high voltage permits the most economical transmission of electrical energy over the considerable distances now covered by primary distribution, while low voltage is generally required for the safe and convenient operation of utilization devices, such as motors, lamps, etc. In alternating-current distribution it is customary to change this high voltage of the primary to the low voltage of the secondary by means of transformers. In direct-current circuits (and to a large extent in alternating-current secondary circuits also) what is known as the 3-wire system is employed. Proper grounding of low-potential circuits, such as direct-current 3-wire and alternating-current two or three wire, is recognized as an important factor in reducing both the life hazard and fire hazard in premises supplied from low-voltage circuits, because of the possibility of accidental contact between these circuits and higher-voltage circuits. The danger to persons or inflammable materials is in shunting a portion of an electric

circuit having a large potential drop, or in being subjected to the heat developed where a large drop of potential along a conducting path, or at an arc, develops large amounts of heat. The former is a danger to persons, the latter to combustible materials and sometimes to persons in the vicinity.

Since persons are very frequently in contact with plumbing fixtures, reinforced concrete, gas and electric fixtures, damp floors and other surfaces in electrical connection with the earth, their greatest danger of shunting an electrical circuit comes from touching a single conductor of a circuit, elsewhere in contact with earth, and having at the point of contact a different potential than the earth. So many persons have been injured or killed by coming in contact with low-voltage conductors raised accidentally to high potential above earth by contact with or leakage from high-voltage circuits that the undue rise of potential above earth in conductors to which the public has access should always be prevented by the use of effective protective ground connections on the low-voltage conductors.

It is essential that the ground connection be of low resistance and continuously maintained; therefore it is advisable not to depend upon grounding at one point even if the ground connection is frequently inspected and shows a constant low resistance, but to ground the same conductor at several points. For direct-current systems it is, however, necessary to restrict the number of ground connections and to depend on the adequacy of the ground connection at the station.

DANGEROUS VOLTAGE.—Since the passage of electric current through the human body depends upon the bodily resistance and the condition of the surfaces of contact as well as upon the voltage, no definite demarcation can be made between voltages to be classed as safe and those to be classed as dangerous. It is generally agreed, however, that voltages above 150 are much more hazardous than those below 150. There is consequently a general sentiment in favor of inclosing or otherwise guarding against personal contact all ungrounded conductors of more than 150 volts to ground. Since many circuits and equipment of voltage lower than this are exposed to possible contact, and since such circuits are frequently exposed to the possibility of having higher foreign voltages imposed upon them, it is considered good practice to ground the circuits of lower voltage. Even for higher-voltage circuits, grounding is generally advisable if there is any exposure to other circuits of still higher voltage.

METHODS OF GROUNDING.—There are several methods of varying value employed to secure electrical connection of low-voltage circuits with the earth. The most satisfactory method is to connect to underground metallic water pipes wherever this is possible. The resistance of pipe joints is usually low, the pipes present a large surface in intimate contact with the earth, and the piping systems are electrically continuous with the plumbing and heating fixtures with which people come in contact.

Unfortunately it is still the case that some water companies and water departments of municipalities are reluctant to give permission to ground low-voltage circuits on their water pipes. No difficulty due to electrolysis will be experienced, however, as ordinarily no appreciable current will flow to or from the pipes. On direct-current systems grounding is carried out at only one point. The majority of systems to be grounded transmit and distribute energy by alternating current, and the electrolytic effect of alternating currents is inappreciable. Under abnormal conditions considerable current might flow temporarily, but this would not injure the pipes and would produce a disturbance in the electrical system which would be at once detected and corrected. Electrolysis due to direct-current street-railway systems is often serious, but none can arise from the proper grounding of lighting circuits.

Where underground water pipes are not available for making a ground connection other methods must be resorted to. Driving a piece of metallic pipe several feet into the earth and burying metallic plates are common methods. If a buried ground plate or a metal pipe or rod driven into the earth be used, it is necessary that permanent moisture be reached and that sufficient area of contact between pipe and soil be provided, otherwise a permanent low-resistance ground contact can not be obtained. Moist conducting earth is not always within reach and pipe or plate grounds should not be chosen under such conditions.

SIZE OF GROUND WIRE.—The proper size of wire to use in making ground connections depends upon the amount of current that might flow through such ground connection under abnormal conditions. In general, it may be considered adequate to make the current-carrying capacity of the ground wire equal to that of the conductor to which such wire is attached. The National Electrical Safety Code specifies that the ground wire shall not be smaller than No. 6 in any case, this being partly to assure sufficient mechanical strength.

RESISTANCE TO GROUND.—It is important that the resistance between the grounded conductor and the earth be permanently kept low in order to reduce to a minimum the voltage drop due to current passing from conductor to ground, especially where under abnormal conditions a large current might flow. The effect of a high resistance ground may be illustrated by the following example: Assuming that a single 30-ohm ground connection was required to carry 50 amperes (and this is less than the current on some primary distribution systems that might cross the secondary) and that the combined feeder load and leakage current to ground was less than the protective value of the circuit overload limiting devices, then a drop of 1,500 volts would occur between the ground wire and earth. Clearly, under these conditions, such ground connection would not eliminate the life hazard. In the case supposed, the energy expended would be 75,000 watts and the resultant heating might become a source of fire hazard.²⁸

3. COMMISSION JURISDICTION AND PROCEDURE WITH REFERENCE TO ACCIDENTS.

The laws under which most of the public-service commissions are constituted give the commissions authority to require reports of accidents occurring in the operation and conduct of public-utility enterprises, and in many instances this authority extends much further, so that commissions may issue orders prescribing safety rules and regulations.

It has seemed desirable to present a summary of the powers of the various State commissions with reference to accidents and safety provisions. The sections of the laws of the States bearing directly on the safety of operation and on the reporting and investigation of accidents have been compiled and will be found on pages 320–326 of this circular.

In addition to the sections of the laws referred to, the present status of the various commissions' safety and accident activities is concisely shown by the following brief statements from the commissions themselves:

ALABAMA.

This commission has issued no general orders or regulations applying to this matter. There are, of course, regulations of individual utilities of this class which pertain in greater or less degree to this subject, which regulations have been approved by this

²⁸ Rules for grounding will be found in the National Electrical Safety Code and a detailed discussion of ground connections is given in *B. S. Tech. Paper No. 108, Ground Connections for Electrical Systems.*

commission, but further than this no regulations of a general character applying to all such utilities have been provided by this commission.

The regulations of the individual utilities of this class which have been approved by this commission are, in general, such requirements as that all installations, renewals, replacements, and repairs must either be made by the utility or if allowed in any case to be made by the consumer, both the material and the labor used in making same and the work as completed are made subject to the inspection and approval of the utility. Such regulations also include, in general, a provision that no consumer is allowed to interfere with the company's distribution system or its operation thereof, but that all causes of complaint against such operation and all requests for any change, renewals, replacements, or repairs of the distribution system must be communicated to the utility by the consumer.

ARIZONA.

The only order issued by this commission covering regulations for safety and accidents is in A. C. C. Order No. 173, General Order No. 37.

Accidents occurring in the operation of gas and electric utilities are not reported to this commission or to any other State official.

After several years litigation, our jurisdiction to prescribe rules for overhead line construction has been confirmed by our State Supreme Court. Our appropriation is not sufficient to make an extended investigation, but there are a few changes that immediately suggest themselves as being desirable to make our rules more nearly meet local conditions.

ARKANSAS.

This commission has no jurisdiction over public utilities within incorporated cities and towns, therefore have adopted no service rules governing such utilities.

CALIFORNIA.

Chapter 499, statutes of 1911, as amended by chapter 600, statutes of 1915, regulates the construction and use of overhead electric lines.

Chapter 500, statutes of 1911, as amended by chapter 575, statutes of 1917, regulates the construction and maintenance of manholes, etc., in underground distribution systems.

General Order No. 26 of the California Railroad Commission regulates clearances and construction at crossings of overhead electric lines over each other and over highways, railroads, etc.

General Order No. 64, California Railroad Commission, effective July 1, 1922, combines the requirements of previous statutes and orders effecting overhead electric lines and includes many additional standards of construction for such lines under all conditions.

Utilities are required to report to the commission annually the number and character of accidents on their systems. Such investigations and orders are made as seem advisable to the commission.

COLORADO.

In regard to the commission's action with reference to safety and accidents in electric light and power utilities * * * Rule VII of the rules regulating service requires that such accidents be reported to the commission, but compliance with this rule has not been enforced. The commission has, however, entered into a great many informal complaints in connection with the hazards of overhead construction and has been able to get action without formal hearings, usually in reasonable conformance to the National Electrical Safety Code.

CONNECTICUT.

All accidents are reported to the commission as required by the public utilities law and the service rules of the commission.

DISTRICT OF COLUMBIA.

Order No. 6, "*In re* Reports of accidents," dated April 1, 1913, has been issued.

Beyond the adoption of this order the commission has issued no rules or regulations specifically providing safety appliances or tending toward accident prevention. The accidents reported to the commission, however, are carefully analyzed and those which require it are investigated for the purpose of ascertaining whether existing conditions are such as to merit the exercise by the commission of its powers of requiring any changes in the practices or appliances of the utilities.

IDAHO.

We beg to advise you that steps taken by the commission relative to rules on standards of service and safety provisions are all embraced within General Order No. 5 requiring report from the utility of every accident occurring on the property of the utility within the State of Idaho, resulting in loss of life or fatal injury to persons or damage to property of the utility of more than \$150, following which the commission makes an investigation to determine the cause and whether same was under ordinary prudent precautions preventable, or whether like conditions exist at other points or places in the utility's place; and, if so, require steps to be taken to eliminate possibility of similar accidents.

The commission has also, through its General Order No. 10, promulgated rules governing the construction of pole, wire, and cable lines, providing therein for standards of construction which are believed to be necessary to safeguard the employees and general public. These two orders, Nos. 5 and 10, cover all steps taken by this commission in the providing of standards for safeguarding construction and operation of electric utilities within the State of Idaho.

ILLINOIS.

Under section 56 of the act creating the Public Utilities Commission, all public utilities are required to report every accident occurring or that may occur to or on its plant, equipment, or other property, of such a nature as to endanger the safety, health, or property of any person. The commission is vested with the power to investigate any accidents and to issue such orders as, in their judgment, are reasonable and which will operate to prevent a recurrence. The most serious accidents on electric and telephone lines resulting from electric shock are investigated in the field to determine whether the accident occurred because of failure to comply with construction rules (General Order No. 30), and, if possible, to guard against a recurrence of a similar accident.

INDIANA.

The commission has not formulated general rules or regulations governing the report of accidents, as covered by section 123 of the public utility act of this State.

IOWA.

The commission has issued orders for the construction, operation, and maintenance of 6,600 volt lines and for crossings of electric light and power lines over railroads.

KANSAS.

Section 32 of our public utility laws does not empower the commission to issue any rules, regulations, or orders in regard to means of safety. The law requires the common carriers and public utilities, whenever an accident occurs attended with loss of human life or serious personal injury, to give immediate notice thereof by telegraphing the commission.

The commission has been given authority over the stringing of wires along, over, and across public highways * * * but was not directly given any authority with respect to public safety and accidents. Docket 1944 is an order covering the stringing of wires along and across highways and at railroad crossings.

LOUISIANA.

This commission has only recently acquired jurisdiction over this class of utilities and as yet it has prepared no rules and regulations concerning the subject.

MARYLAND.

The reporting of all accidents is required by the electric service rules issued by the commission (section H of order No. 2599).

MICHIGAN.

The commission has issued specifications for stringing wires over railroads, and order No. 1692 requires monthly reports on accidents from all electric utilities.

MISSOURI.

The commission has issued no general rules or regulations with reference to safety and accidents in connection with the operation of gas and electric utilities in this State.

With reference to reporting of accidents occurring in connection with the operation of gas and electric utilities, please be referred to section 7827, R. S., Mo., 1909, which reads as follows:

"All accidents in manufacturing, mechanical, mercantile, or other establishments or places within this State where labor is employed which prevent the injured person or persons from returning to work within two weeks after the injury, or which result in death shall be reported by the person in charge of such establishment or place to the factory inspector or deputy inspector, or one of the assistant inspectors provided for by this chapter, and also to the city or county physician, when there be such an officer, which notice may be given by mail."

This section appears to refer to gas and electric utilities.

MONTANA.

Neither the railroad commission law nor the public service commission law of Montana gives this department the authority to prescribe methods of operation with a view of promoting safety. We are required, however, to investigate accidents of importance and make report of same to the governor. (Order No. 81, governing reports of accidents of public utilities other than railroads, Jan. 12, 1914.)

The commission has, in some of the more serious accidents, perhaps gone beyond its authority in the matter of making investigations, although we are not authorized to order improved methods of operation.

NEBRASKA.

The commission has issued two orders relating to wires at crossings.

NEVADA.

The Nevada Industrial Commission, Carson City, Nev., investigates closely accidents occurring in the operation of gas and electric utilities.

The commission has issued under date of September 15, 1911, safety regulations for electric utilities, and on July 24, 1920, rules for overhead and underground lines.

NEW HAMPSHIRE.

SECTION 15, paragraph (b) of the public utility law, requires all public utilities to report to this commission the accidents to its employees. The commission, however, has never issued any rules, regulations, or orders in connection with this provision. No other State authority has, to our knowledge, any jurisdiction over the investigation of these accidents.

NEW JERSEY.

The board requires reports to be made to it of all accidents which may occur in connection with the operation of railroads and street railways. The board, while it has the power under the act to require reports to be made to it of accidents of other utilities, has not so far deemed it necessary to require such reports to be made.

All accidents at gas and electric light plants are reported to the Employers' Liability Commission of this State. Any serious accident occurring in connection with the operation of gas or electric utilities would be investigated by inspectors of this board.

Inspectors of the board are continually visiting plants of gas and electric lighting utilities and conditions discovered as the result of their investigation, which might, if continued, lend to accidents, are reported and corrections required to be made.

NEW YORK.

The orders of the former first district commission have been continued in force by the present commission.

Case No. 1628 has to do with the safeguarding and protecting* of employees from injuries by high tension electrical apparatus, or other dangerous conditions, January 13, 1914.

Case No. 1773, dated December 29, 1913, required "Notice to be given by each gas corporation, electrical corporation, and steam corporation of every accident happening upon its premises, or in connection with the manufacture and distribution of gas, electricity, or steam."

Case No. 2171, effective January 17, 1917, provides for the installation of electric wires and appliances.

The former Second District Commission had not issued any rules or regulations governing safety provisions. An order has been made which requires electric and gas corporations to report each accident promptly. After receiving such reports the commission requests such further information or makes such further investigations by its own agents as appear to be advisable.

NORTH CAROLINA.

The corporation commission has not taken any action under chapter 127 of the laws of 1913, except to issue a standard for wire crossings (December 3, 1920).

The commission has approved a number of contracts for the different classes of electric service, which includes specification. These specifications have so far as practical conformed with standards in Circular 56 of the Bureau of Standards.

NORTH DAKOTA.

This commission has adopted standards of electric service and nothing was included in them regarding reporting of accidents.

Some companies are reporting all accidents resulting in loss of life, but the commission has not at the present time adopted any rule requiring such reports. Hazard and inductive interference rules became effective November 1, 1920.

OHIO.

All accidents, as well as service complaints, are carefully investigated and if adjustments and corrections can be made they are, of course, applied.

Order No. 65, issued March 6, 1922. This code is really a set of specifications which govern the construction of all overhead wire lines. It is very similar to the National Electrical Safety Code, except some of its provisions are more stringent. This code was authorized under the Ohio General Code, 8975-6.

OKLAHOMA.

Rule 40 of Order 2072 covers the construction, operation, and maintenance of the plant, facilities, and equipment to comply fully with the requirements of the National Electrical Safety Code and the National Electrical (Fire) Code. It also provides for

the keeping of a record of all accidents. This, we believe, is a good step toward the prevention of accidents and the development of a less hazardous electrical system within the State.

OREGON.

The commission, in accordance with section 552 of the public-utility act of this State, requires all accidents to be reported to us, said reports including accidents occurring in the operation of gas and electric utilities. Serious accidents are investigated by the commission.

The commission has issued "General regulations governing overhead and underground construction of telegraph, telephone, signal, trolley, and power lines within Oregon," as amended and effective, May 12, 1914.

PENNSYLVANIA.

Accidents occurring in the operation of gas and electric utilities are reported to this commission if they are not considered industrial accidents.

Accidents of an industrial character are reported to the Department of Labor and Industry, Harrisburg, Pa.

1. Report must be filed of all accidents resulting in loss of life or injury to persons, with two exceptions, as follows: (a) No report need be filed to accidents to employees where the incapacitation is for a period of 3 days or less. (b) No report need be filed of accidents to employees which occur in repair shops, construction shops, and other places remote from the line of operation.

2. In case of accident of a serious or unusual character involving death or serious injury to others than trespassers, a telegraphic report must be made at once, followed by the usual written report.

General Order No. 13 covers the construction of the crossing of the wires of a public service company over or under the facilities of another public service company. The Department of Labor has issued the "Electrical code," which consists of parts 1, 3, and 4 of the National Electrical Safety Code.

RHODE ISLAND.

Relative to the procedure of the commission with reference to safety provisions and accident prevention and investigation, we would say that no general rules or regulations have been established.

TENNESSEE.

The statutes under which this commission operates do not confer upon it any specific duties or requirements as to regulations with reference to safety and accidents. The only rules and regulations promulgated by this commission relating to the question matter are those with reference to construction and maintenance of overhead wires across railroad tracks to provide safety for trains, locomotives, and employees of railroad companies (issued June 9, 1921).

UTAH.

No rules or regulations have been issued regarding the procedure of the commission with reference to accidents occurring on electric lines.

The commission has adopted a tentative general order covering the use of the National Electrical Safety Code. (Adopted February 15, 1918.)

VERMONT.

In regard to the matter of safety provisions and accident prevention in this State we beg to say that the Public Service Commission has issued no rules, regulations, or orders on safety and accidents in accordance with section 5058 of Chap. 216 G. L. All accidents occurring in the operation of gas and electric utilities in this State are reported to and investigated by the Public Service Commission and not by any other State authority.

VIRGINIA.

This commission has made no rules with reference to safety and accidents in the operation of utilities furnishing electric light and power service.

WASHINGTON.

The legislature has transferred all electrical construction standards and safety features relating to electrical operations from the Department of Public Works to the Department of Labor and Industries. The work is directly under the supervision of an officer in that department, designated as the supervisor of safety. The adoption of the National Electrical Safety Code is under consideration by the department.

WEST VIRGINIA.

Accidents are covered by rule 33 of the general electric service rules. The commission furnishes to all utilities report form No. 60-E, copy inclosed.

These reports are received in the engineering offices of the commission, and are carefully scrutinized, and if, in our opinion, accident is caused by apparent negligence or improper operating conditions in any way attributable to the utility, careful investigation is made, and the necessary steps taken to correct the condition.

WISCONSIN.

The Railroad Commission of Wisconsin is empowered to enact reasonable rules requiring railways and utilities owning, operating, managing, or controlling along, on, or across any public highway or private right of way any line or lines of wire over which electric energy is transmitted or messages are transmitted or conveyed, to construct, operate, and maintain such lines * * * in a reasonably adequate and safe manner and so as not to unreasonably interfere with the service furnished by such other public utility or railroad.

In conformity with the above the Railroad Commission on April 30, 1917, jointly with the Industrial Commission issued rules for safe construction and operation of electric systems.

There is now before the commission a new set of rules which have been passed by an advisory committee and these rules will doubtless be the subject of an order within the next few weeks.

WYOMING.

This commission has not prescribed any particular procedure with reference to safety and accidents in the operation of utilities furnishing electric light and power services, but is governed by the law relating to accidents.

II. THE APPROVAL OF TYPES OF METERS.

The public utility laws of the States of New York, Missouri, and Washington, and of the District of Columbia²⁹ forbid the placing in service of electricity meters, the type of which has not been approved by the public service commission. The provisions of the statutes are seen to be almost identical. At the present time the commissions of the State of New York, and of the District of Columbia have in force regulations defining types and establishing methods of test for the acceptance and approval of types. These rules have been issued under the following titles:

1. Rules, regulations, and specifications governing the approval and types of watt-hour meters. Case No. 279. Adopted September 1, 1921, Public Service Commission, Albany, N. Y.

2. In the matter of regulations for the approval of types of watt-hour meters for use in the District of Columbia. Order No. 197, effective February 1, 1917. Public Utilities Commission, Washington, D. C.

The New York rules are the result of a long period of development, going back to an order of the former First District Commission issued in July, 1909, and amended frequently, and the order of the Second District Commission adopted in 1911. The rules now in force are applicable throughout the State, the two commissions having been consolidated (1920), and one set of rules issued. These rules are based primarily on the specifications proposed by the Bureau of Standards in the first edition of this circular (1916). The rules now in force in the District of Columbia are also based on the bureau's proposals.

All specifications for the acceptance and approval of types of electricity meters are derived from the Code for Electricity Meters³⁰ of the joint meter committees of the Association of Edison Illuminating Companies and the National Electric Light Association. The draft of a proposed specification for the approval

²⁹ No person, corporation, or municipality shall furnish, set or put in use any electric meter, the type of which has not been approved by the commission (N. Y. Laws of 1910, chap. 480, sec. 67 (3)).

No corporation, person, or municipality shall furnish, set or put in use any electric meter, the type of which shall not have been approved by the commission (Missouri, Laws of 1913, Public Utilities Law, sec. 71(3)).

No public-service company shall furnish, set or put in use any electric meter, the type of which shall not have been approved by the commission (Washington, Laws of 1911, chap. 117, sec. 74).

No corporation or person shall furnish, set or put in use any electric meter, the type of which shall not have been approved by the commission, or any meter not approved by an inspector of the commission. (Public, No. 435, H. R. 28499, approved March 4, 1913, sec. 8, par. 57) (Dist. of Columbia).

³⁰ Code for Electricity Meters, prepared by the Electrical Testing Laboratories under instructions of the joint meter committees of the Association of Edison Illuminating Companies and of the National Electric Light Association. 1912.

of meters, published in the first edition of this circular, was based on this code, though the arrangement and certain tolerances were different. In March, 1922, application was made to the American Engineering Standards Committee by the group known as the Electric Light and Power Group in the A. E. S. C. for the approval of the code as an American standard. The committee acted favorably on this application and in July, 1922, the Code for Electricity Meters was approved as an American standard. It is now in process of revision by a sectional committee, according to the procedure of the American Engineering Standards Committee, under the joint sponsorship of the National Electric Light Association, the Association of Edison Illuminating Companies, and the Bureau of Standards.

It has, therefore, been deemed wise not to present in this edition of this circular a specification for the approval of types of electricity meters. The revision of the Code for Electricity Meters should be completed within a year or two, and being approved as an American standard, should then be accepted by public-service commissions in all the States interested, as the basis for their approval of types of meters in accordance with the public-utility laws. In the service rules of Illinois, Michigan, Oklahoma, and Wisconsin the code requirements and tolerances are now made the basis for the rules governing periodic tests on watthour meters.

III. RULES AND REGULATIONS FOR ELECTRIC SERVICE AS ADOPTED BY STATE PUBLIC UTILITY COMMISSIONS.

Rules and regulations for electric service, commonly called standards for electric service have been adopted in 22 States and the District of Columbia. The following list of the various State orders is made as complete as possible (July, 1923) and includes both standards for safety and adequacy of service.

The orders here collected and reprinted to show present commission practice cover, however, only standards for electric service; rules covering safety of construction, and based largely or entirely on the National Electrical Safety Code, are not reprinted. It is believed that the list of orders is complete and includes all orders and rules issued.

They have been published by the commissions under the following titles. A reference to place of publication is given in most cases.

COMMISSION ORDERS ON ELECTRIC SERVICE AND SAFETY.

ARIZONA.

[Corporation Commission, Phoenix, Ariz.]

(a) Docket No. 158. In the matter of the investigation of the manner of delivery and charge to be made for water, electrical energy, and gas * * *. March 28, 1914. 2d Annual Report, 1913-14, p. 199.

(b) Docket 173. In the matter of overhead line construction. General Order No. 37. 2d Annual Report, 1913-14, p. 230. Effective July 1, 1914.

(c) Docket 112. *In re* Standards for gas and electric service. Effective May 1, 1915. 3d Annual Report, 1914-15, p. 147.

(d) General Order No. 43. Effective June 1, 1915. 3d Annual Report, 1914-15, p. 421.

(e) Docket No. 259. In the matter of metered service for electrical consumption. November 15, 1915. 4th Annual Report, 1915-16, p. 228.

CALIFORNIA.

[Railroad Commission, San Francisco, Calif.]

(a) Decision 2879. Case No. 683. In the matter of the practice of water, gas, electric, and telephone utilities requiring deposits before rendering service. Effective December 1, 1915. Opinions and Orders, vol. 8, p. 372.

(b) General Order No. 26. Regulations governing clearances and construction at crossings of railroads, street railroads, telegraph, telephone, signal, trolley, and power lines with each other and with street and public highways; also other overhead and side clearances of railroads, street railroads, and wire lines. Effective January 1, 1913. Report 1912-13, p. 607.

(c) General Order No. 52. *Re* Construction and operation of electric power and communication lines. Effective August 1, 1918. (P. U. R. 1919 B, p. 643.)

(d) Decision 6542, Opinions and Orders, vol. 17, p. 143, contains rules applicable to particular operating company as to meter accuracy, testing, etc. Substantially the same rules are in effect for all important operating companies in the State.

(e) Chap. 499 of Statutes of 1911 amended by chap. 600 Statutes of 1915, and chap. 500, Statutes of 1911, cover overhead and underground construction, respectively, and specify clearances between poles and wires, circuits of different voltages, marking of high voltage circuits, size of manholes and vaults, etc.

(f) General Order No. 64. Rules for overhead line construction. Adopted May 1, 1922. Effective July 1, 1922.

COLORADO.

[Public Utilities Commission, Denver, Colo.]

(a) Case No. 84. *In re* Rules regulating gas, electric, and water service of all privately owned and municipally owned gas, electric, and water public utilities operating within the State of Colorado. Effective January 1, 1917.

CONNECTICUT.

[Public Utilities Commission, Hartford, Conn.]

(a) Docket No. 1447. Order B. Order approving and establishing rules, regulations, and standards for electric companies. In effect August 1, 1915.

Rule E3, "Pole identification" was modified by an order of the commission dated February 2, 1916, and the modified rule replaces the original.

(b) Docket No. 1447. Order D. *Re* Standards for joint wood-pole line construction. Effective April 1, 1917. P. U. R. 1917 C, p. 938.

DISTRICT OF COLUMBIA.

[Public Utilities Commission, Washington, D. C.]

(a) Order No. 139. In the matter of regulations for electric service in the District of Columbia. Effective February 15, 1915. Annual Report, 1915, p. 92.

(b) Order No. 140. In the matter of the submission of certain information by electrical corporations. Effective January 30, 1915. Annual Report, 1915, p. 34.

(c) Order No. 148. In the matter of the rate of interest to be paid on deposits required by utilities. Effective May 1, 1915. Annual Report, 1915, p. 42.

(d) Order No. 172. In the matter of the submission of certain information by electrical corporations. Effective December 8, 1915. Annual Report, 1915, p. 65.

(e) Order No. 197. In the matter of regulations for the approval of types of watt-hour meters for use in the District of Columbia. Effective February 1, 1917, 4th Annual Report, 1916, p. 72.

This order lays down definite specifications according to which types of watt-hour meters shall be tested, and thereupon approved by the commission. The order follows very closely the suggested specifications given in the first edition of this circular.

(f) Order No. 202. Amendments to regulations for electric service in the District of Columbia. Effective February 27, 1917, amending order 139. 5th Annual Report, 1917, p. 35.

(g) Order No. 368. In the matter of rules, regulations, and practices of the Potomac Electric Power Co. covering the extension of service mains and the rates and charges therefor. March 23, 1920. 8th Report, 1920, p. 59.

(h) Order No. 396. In the matter of rules, regulations, and practices of the Potomac Electric Power Co. covering the extension of service mains and the rates and charges therefor. November 18, 1920. 8th Report, 1920, p. 80.

This order amends order No. 368.

IDAHO.

[Public Utilities Commission, Boise, Idaho.]

(a) General Order No. 10. In the matter of promulgating and establishing rules governing the construction of pole, wire, and cable lines, of telegraph, telephone, signal, electric power, and other circuits of similar character, and for the crossings of wires or cables of telegraph, telephone, signal, electric power, and other circuits in the State of Idaho. Effective March 1, 1915. Report 1914-15, p. 212.

(b) General Order No. 5. Regulations governing reports of accidents of public utilities other than railroads and street railroads. Effective July 15, 1913.

ILLINOIS.

[Commerce Commission, Springfield, Ill.]

[Prior to July 1, 1921, the commission was known as the Public Utilities Commission, and all rules here listed were promulgated by that body.]

(a) General Order No. 65. In the matter of rules establishing standards of service for electric utilities. Effective January 1, 1921.

(b) General Order No. 30, as amended. In the matter of rules for overhead electrical construction. March 16, 1920.

(c) General Order No. 59, as amended. In the matter of the construction, ownership, and maintenance of electric distribution circuits in rural districts, and establishing practices, rules, and regulations which shall be the basis of rates for the furnishing of electric service in rural districts. Effective January 1, 1921.

Rural consumers are defined as any consumer, except industrial light and power consumers, located outside the corporate limits of an incorporated municipality.

INDIANA.

[Public Service Commission, Indianapolis, Ind.]

(a) Rules and standards of service for electrical utilities in Indiana. Effective May 1, 1920.

(b) Principles and Regulations for Safety and Inductive Coordination. Cause No. 6796. Effective November 1, 1922.

IOWA.

[Board of Railroad Commissioners, Des Moines, Iowa.]

(a) *Re* Electrical interference between transmission, telephone, and telegraph lines. Rules for the construction of overhead high-tension lines crossing or paralleling overhead telephone and telegraph lines; and for crossings of electric light and power lines over railroads. December 30, 1916. 40th Annual Report, 1917, p. 11. P. U. R. 1917 B, p. 800.

(b) Rules for the construction, operation, and maintenance of electric transmission lines of 6,600 volts and less between line conductors. April 12, 1922.

KANSAS.

[Public Utilities Commission, Topeka, Kans.]

(a) Docket 1944. In the matter of the investigation for the establishment of rules and regulations governing the stringing of wires along and across highways and at railroad crossings. July 30, 1917.

Supplemental orders 1 and 2, dated January 21, 1921, of the Court of Industrial Relations, adopt the rules in Docket 1944 promulgated by the former utilities commission, and add paragraph 307 under section 3 of said rules, covering clearances of overhead lines.

MARYLAND.

[Public Service Commission, Baltimore, Md.]

(a) Order No. 2599. Standards, rules, and regulations for electrical corporations in the State of Maryland. Effective February 1, 1916. Report 1916, p. 55.

(b) Order No. 1378. In the matter of the rules and regulations of the Consolidated Gas Electric Light & Power Co., of Baltimore, for connection and house wiring, etc. Case 554. Order of September 4, 1913, Reports, vol. 4, p. 334 (1913).

The order covers classes of currents, service wiring, meters, fuses, interior and sign wiring, arc lamps, heating and cooking appliances and miscellaneous devices, and motors.

MICHIGAN.

[Michigan Public Utilities Commission, Lansing, Mich.]

(a) Specifications for stringing power wires over railroads in Michigan. June 8, 1910.

(b) Specifications for stringing lighting or power current wires carrying 800 volts or less over railroads in Michigan. June 8, 1910.

(c) Standards of electrical supply service to consumers. Order No. 1692. Effective July 1, 1922. [A revised order 1692 became effective July 1, 1923.]

MISSOURI.

[Public Service Commission, Jefferson City, Mo.]

(a) General Order No. 20. Rules regulating gas, electric, and water service. Effective October 1, 1915.

MONTANA.

[Public Service Commission, Helena, Mont.]

(a) An act relating to the construction, operation, use, and maintenance of all electric construction, appliances, and apparatus * * * Approved March 15, 1917.

(b) Rules and Regulations prescribing standards for electric service, providing for the testing of meters and otherwise regulating the service of electric utilities. Adopted November 19, 1921. Effective December 1, 1921.

(c) Order No. 81.—Governing reports of accidents of public utilities other than railroads. January 12, 1914.

NEBRASKA.

[Railroad Commission, Lincoln, Nebr.]

(a) Rules relating to overhead lines at crossings and conflicts, or involved in parallels. Effective September 5, 1919.

(b) Regulations prescribing the manner in which any and all wires shall cross under or over any track of a railroad in Nebraska at public highway crossings, in conformance with the requirements of House Roll No. 217, enacted by the legislature of 1915. Effective August 19, 1915.

NEVADA.

[Public Service Commission, Carson City, Nev.]

(a) Circular No. 1. Rules and instructions for gas and electric service in the State of Nevada. June 3, 1911. 1st Annual Report, 1911, p. 384.

(b) Supplement to Circular No. 1. October 15, 1911.

Cancels rule 20 of Circular No. 1, substitutes rule 20A and adds rules 25 and 26.

(c) Rules for overhead and underground lines for electric utilities, July 24, 1920.

(d) Safety regulations for electric utilities. September 15, 1911.

NEW HAMPSHIRE.

[Public Service Commission, Concord, N. H.]

(a) Order No. 314. Rules prescribing standards for electric service and providing for the testing of meters and otherwise regulating the service of electric utilities. Effective July 1, 1914. Reports and Orders, vol. 4, 1914, p. 328.

(b) Order No. 1033. Effective May 1, 1920. Reports and Orders, vol. 7, 1920, p. 373.

Amends Order 314 by adding a rule 14A on "Standard frequency."

NEW JERSEY.

[Board of Public Utility Commissioners, Trenton, N. J.]

(a) No. 148. Rules, regulations, and recommendations for electrical supply utilities and for all utilities owning or using poles and wires. Adopted December 9, 1913. 4th Annual Report. 1913, p. 235. Reports, vol. 2, p. 275.

NEW YORK.

[Public Service Commission, Albany, N. Y.]

(a) Case No. 278. Rules and regulations relative to the testing of watthour meters and to the reporting of such tests to the commission. Approved December 28, 1921.

The order in this case abrogates order in case 2202, adopted May 23, 1917.

(b) Case No. 279. Rules, regulations, and specifications governing the approval of types of watthour meters. September 1, 1921.

(c) Case No. 2115. Regulations and requirements governing the installation of electrical services in buildings and materials used in connection therewith. Effective July 1, 1917. 7 P. S. C. R., First District, N. Y., p. 372. P. U. R., 1917 B, 441.

(d) Case 2062. Regulations and requirements governing the installation and use of electrical equipment by public service corporations. Effective April 13, 1916. 7 P. S. C. R. First District, N. Y., p. 310.

(e) Case No. 2171. Rules and regulations for installation of electric wires and appliances. Gas and steam corporations. January 17, 1917. 8 P. S. C. R. First District, N. Y., p. 367. P. U. R. 1917 C, 263.

(f) Case No. 1628. Regulations as to all public service corporations with reference to safeguarding and protecting employees from injury by high-tension electrical apparatus and other dangerous conditions. 6 P. S. C. R. First District, N. Y., p. 461.

(g) Case No. 2499. In the matter of requiring all electrical corporations * * * to stencil and number their poles and structures for carrying overhead lines. March 8, 1912. Report 1912, vol. 1, p. 900.

(h) Case No. 1923. In the matter of prescribing requirements to govern the practice of gas corporations and electrical corporations respecting consumer's deposits. Reports, 1910, vol. 1, p. 951; 1911, vol. 1, p. 821; 1912, vol. 1, p. 897.

(i) In the matter of totalizing watthour meters. May 13, 1912. Effective September 1, 1912. Report 1912, vol. 1, p. 908.

(j) Case No. 1845. Circular No. 65. Regulations governing the filing of contracts and prescribing the form and governing the filing and publication of rate schedules of gas corporations, and electrical corporations, and municipalities. December 29, 1914. Amended January 28, 1915, and May 21, 1918.

(k) Case No. 1773. Notice to be given by each gas corporation, electrical corporation, and steam corporation, of every accident happening upon its premises, or in connection with the manufacture and distribution of gas, electricity, or steam. December 29, 1913.

NORTH CAROLINA.

[Corporation Commission, Raleigh, N. C.]

(a) Rules and specifications for wire crossings. December 3, 1920.

(b) Supplemental rules and specifications for wire crossings over railroads. March 10, 1921.

NORTH DAKOTA.

[Board of Railroad Commissioners, Bismarck, N. Dak.]

(a) Hazard and inductive interference rules. *In re* Rules and regulations for avoidance or mitigation of hazard to persons or property and avoidance or mitigation of inductive interference. Effective November 1, 1920.

(b) Standards of electrical service, established by the Board of Railroad Commissioners of North Dakota. June 1, 1920.

OHIO.

[Public Utilities Commission, Columbus, Ohio.]

(a) Administrative Order No. 65. Rules, regulations, and specifications for situations where electric lines cross or more or less parallel the line of a railroad, interurban railway, or other public utility, in appliance with sections 8975-8976, General Code. March 6, 1922.

OKLAHOMA.

[Corporation Commission, Oklahoma City, Okla.]

(a) Order No. 1946. Prescribing rules governing the construction of telephone, telegraph, electric lines, and power transmission lines. Adopted October 31, 1921.

(b) Tentative instructions for the various public utilities, companies, and operators in Oklahoma for study and trial in the matter of construction and operation of power and communication lines for the prevention or mitigation of inductive interference.

(c) Order No. 2072. Rules and regulations prescribing standards for electric service and providing for the testing of meters and otherwise regulating the service of electric utilities in the State of Oklahoma. June 29, 1922.

OREGON.

[Public Service Commission, Salem, Oreg.]

(a) File UF-61. Rules, orders, and regulations relating to standards of quality, pressure, voltage, and other service conditions of gas, heat, light, water, and power utilities in the State of Oregon. Effective July 1, 1914.

(b) File No. UF-56. General regulations governing overhead and underground construction of telegraph, telephone, signal, trolley, and power lines within Oregon. As amended April 23, 1914, and effective May 12, 1914.

(c) Order No. 804. Rules and regulations governing construction of urban service extensions of lighting and power lines within Oregon. February 11, 1922. Effective March 1, 1922.

(d) Order No. 891. Rural service line rules and regulations. Effective October 15, 1922.

[Bureau of Labor, Salem, Oreg.]

(a) Rules covering installation of wires and electrical equipment. Published under authority of section 8353, Oregon laws, July 1, 1921.

PENNSYLVANIA.

[Public Service Commission, Harrisburg, Pa.]

(a) Circular 10A. Rules and regulations pertaining to electric utilities. April 9, 1914.

(b) General order No. 13. In the matter of the regulation of the construction of the crossing of the wires of a public-service company over or under the facilities of another public-service company. Effective June 1, 1917.

[Pennsylvania Department of Labor and Industry, Harrisburg, Pa.]

(c) Electrical Code. Effective July 1, 1917.

Parts 1, 3, and 4 of the National Electrical Safety Code.

SOUTH CAROLINA.

[Railroad Commission of South Carolina, Columbia, S. C.]

(a) Rules regulating the operations and standard of service of electric utilities in South Carolina. Effective October 1, 1922.

TENNESSEE.

[Railroad and Public Utilities Commissions, Nashville, Tenn.]

(a) Specifications, rules, and regulations governing the construction and maintenance of wires across railroad tracks for protection of trains, engines, cars, and operators thereof. June 9, 1921.

Part 1. Telephone, telegraph, and signal line specifications.

Part 2. Light and power line specifications.

UTAH.

[Public Utilities Commission, Salt Lake City, Utah.]

(a) Tentative general order. The P. U. C. of Utah has tentatively adopted the rules of the National Bureau of Standards as contained in their Circular No. 54, covering the National Electrical Safety Code. Effective February 15, 1918.

WASHINGTON.

[Department of Public Works, Olympia, Wash.]

(a) Formal Order No. 493. Rules of the Public Service Commission of Washington for the regulation of gas, electric, and water service. Effective June 15, 1912.

(b) Case No. 1591. In the matter of amending, altering, changing, and supplementing rules contained in chapter 130 of the sessions laws of Washington, 1913, relating to electrical construction, maintenance, and use of electric wires, apparatus, and appliances. August 14, 1914.

Chapter 20, laws of 1921 amended chapter 130, laws of 1913, relating to electrical construction, by extending the time to on or before the first of July, 1931, in which old work was required to be brought up to the standard.

The Department of Labor and Industries is charged with the enforcement of the provisions of above act.

WEST VIRGINIA.

[Public Service Commission, Charleston, W. Va.]

(a) Rules and regulations for the government of electric, water, and gas public utilities. Effective August 1, 1915. Revised to February 1, 1916.

(b) General rules and regulations for distribution and sale of electricity, adopted by a special committee of the Public Utilities Association of West Virginia. Approved and adopted by the Public Service Commission, May 8, 1916.

(c) Rule 36, relative to the combining or consolidation of power meter reading was added to the general rules by order of the commission, dated July 2, 1921.

WISCONSIN.

[Railroad Commission of Wisconsin, Madison, Wis.]

(a) No. U-223, U-960, U-2081. Standards for gas and electric service in the State of Wisconsin.

(b) Joint order of the Railroad Commission and the Industrial Commission establishing the Wisconsin State Electrical Code. Effective September 13, 1922.

(c) U-1951, U-1954. Proposed rules for electric rural extensions; adoption of rules authorized. May 17, 1920. P. U. R. 1920 D, 595.

Rules applicable to certain utilities only, not state-wide.

In order to show clearly the similarities and differences in the service rules so far adopted by State commissions, the rules are here arranged alphabetically under headings. In a number of cases State rules are simply numbered, no title or heading being given. In this circular an attempt has been made to place each rule under the heading best describing the subject matter of the rule. It is believed that all the rules of each commission are included,³¹ and to learn what each State's rules are it is necessary only to read under each heading the rules for the State in question. If no rule is given, none has been adopted.³²

ACCIDENTS.

COLORADO.

RULE 7. Accidents.—Each utility shall as soon as possible report to this commission each accident happening in connection with the operation of its property, facilities, or service wherein any person shall have been killed or seriously injured, or whereby any serious property damage shall have resulted; such first report shall later be supplemented by as full a statement as is possible of the cause and details of the accident, and the precautions, if any, which have been taken to prevent similar accidents. Each utility shall further give all reasonable assistance to the commission in the investigation of the cause and suitable means for the prevention of any such accidents in the future.

INDIANA.

RULE 30. Accidents.—(a) Each utility shall keep a record of and furnish to the commission as soon as possible full reports of all accidents happening in, or about, or in connection with the operation of its plants, stations, property, and equipment wherein any person shall have been killed or seriously injured.

(b) It is expected that all possible care will be exercised by each utility to reduce the life hazard (1) to which the employees are subjected in working in stations and substations and on overhead and underground lines; (2) to which the utility's consumers may be subjected by the introduction of its wires into the residences of the consumers; (3) and to which the general public may be subjected by the presence of overhead wires in the public streets and ways.

³¹ The rules for the acceptance of types of watthour meters of the commissions of New York and the District of Columbia are not here included. See p. 42 for discussion of this subject.

³² In the report of the meter committee of the National Electric Light Association, thirty-seventh convention, technical volume, p. 3, is an excellent chart on Electricity Meter Regulations, U. S. A., 1914. For brief tabular comparison of meter regulations in the various States, up to 1914, this chart is very useful.

MARYLAND.

H. *Accidents*.—Each utility shall as soon as possible report to the commission each accident happening in connection with the operation of its property, facilities, or service, whereby any person shall have been killed, or injured to the extent of three or more days' disability, or whereby any property damage in excess of \$150 shall have been caused. Such first report shall later be supplemented by as full a statement as is possible of the cause and details of the accident and the precautions, if any, which have been taken to prevent similar accidents. And, furthermore, if each utility shall give all reasonable assistance to the commission in the investigation of the cause and suitable means for prevention of any such accidents.

MICHIGAN.

7. *Accidents*.—There shall be kept by each utility a record of all accidents happening in, or about, or incidentally in connection with the operation of its machinery, appliances, transmission, and distribution lines, or other property, whereby any person shall have been killed or seriously injured. Each utility shall furnish monthly to the commission a complete formal report of all such accidents.

NORTH DAKOTA.

RULE 30. *Accidents*.—(a) Each utility shall keep a record of and furnish to the commission as soon as possible full reports of all accidents happening in, or about, or in connection with the operation of its plants, stations, property, and equipment wherein any person shall have been killed or seriously injured.

(b) It is expected that all possible care will be exercised by each utility to reduce the life hazard (1) to which the employees are subjected in working in stations and substations and on overhead and underground lines; (2) to which the utility's consumers may be subjected by the introduction of its wires into the residence of the consumers; (3) and to which the general public may be subjected by the presence of overhead wires in the public streets and ways.

OKLAHOMA.

RULE 40. *Accidents*.—(a) Each utility shall keep a record of, and furnish to the commission upon request full reports of all accidents happening in, or about, or in connection with the operation of its plants, stations, property, and equipment wherein any person shall have been killed or seriously injured.

(b) All construction, operation, and maintenance of the plant, facilities, and equipment of each electric utility shall comply fully with the requirements of the National Electrical Safety Code and the National Electrical (Fire) Code, thereby taking all possible care to reduce the life hazard (1) to which employees are subjected in working in stations and substations and on overhead and underground lines; (2) to which the utility's consumers may be subjected by the introduction of its wires into the residences of the consumers; (3) and to which the general public may be subjected by the presence of overhead wires in the public streets and ways.

PENNSYLVANIA.

No. 9. *Accidents*.—Each utility shall keep a record of and shall furnish to the investigator of accidents for the commission, in accordance with the rules of the commission, reports of any and all accidents happening in or about, or in connection with the operation of its property, facilities, or service, wherein any person shall have been killed or injured, or property damaged or destroyed, with a full statement so far as possible of the causes of such accidents, and the precautions, if any, taken as prevention against future accidents of similar character.

SOUTH CAROLINA.

RULE 8. Accidents.—Each utility shall, as soon as possible, report to the commission each accident happening in connection with the operation of its property, facilities, or service, wherein any person shall have been killed or seriously injured, or whereby any serious property damage shall have been caused. Such first report shall later be supplemented by as full a statement as is possible of the cause and details of the accident, and the precautions, if any, which have been taken to prevent similar accidents. Such reports or statements shall be kept confidential by the commission, and shall not be accessible for public inspection.

WEST VIRGINIA.

RULE 33. Accidents.—(a) Every utility shall keep a record of and furnish to the commission as soon as possible full reports of every accident happening in, or about, or in connection with the operation of its plants, stations, property, and equipment, whereby any person shall have been killed, or seriously injured, or any property damaged or destroyed, with a full statement of the cause of such accident, and the precautions taken to prevent similar accidents in the future, and shall at once make full report thereof to the commission on blanks furnished by the commission.

(b) It is required that all possible care will be exercised by every utility to reduce the life hazard (1) to which employees are subjected in working in stations and substations and on overhead and underground lines; (2) to which the utility's consumers may be subjected by the introduction of their wires into the residences of the consumers, and to which the general public may be subjected by the presence of overhead wires in the public streets and ways. It is also required that every utility will so conduct its affairs as to cause the least possible danger or loss to other public utilities which make use of the public streets and roads, either overhead or underground.

ACCURACY REQUIREMENTS FOR DEMAND AND WATT-HOUR METERS.**ARIZONA.**

RULE 13. No electric meter shall be placed in service or allowed to remain in service which has an error of registration in excess of 3 per cent on light load, half load, or full load.

COLORADO.

RULE 35. Accuracy requirements for service watthour meters.—(a) No service watthour meter that has an incorrect register constant, test constant, gear ratio, or dial train, or that registers upon no load ("creeps"), shall be placed in service or allowed to remain in service without proper adjustment and correction.

(b) No service watthour meter that has an error in registration of more than plus 2 or minus 3 per cent at light load, or plus or minus 2 per cent at heavy load, shall be placed in service. Whenever on installation, periodic or any other tests, a meter is found to exceed these limits, it must be adjusted. A meter creeps when, with all load wires disconnected, the moving element makes one complete revolution in 10 minutes or less.

(c) Light load shall be construed to mean approximately 5 to 10 per cent of the rated capacity of the meter. Heavy load shall be construed to mean not less than 60 per cent nor more than 100 per cent of the rated capacity of the meter.

(d) Meters installed with instrument transformers or shunts shall be tested jointly with such transformers or shunts; otherwise the ratio of transformation of the transformers and the resistance of the shunts must have been previously determined within five years and be on file at the office of the utility for use in calculating the

results of tests made. All such calibration tests must have been made by a laboratory of recognized standing or by the utility using apparatus and methods approved by this commission.

CONNECTICUT.

RULE E-14. Computation of average error.—(a) For the purpose of preinstallation and periodic tests, there shall be determined, at each of the following loads, the average of the results of two tests not differing by more than 1 per cent and continuing for at least 30 seconds each:

(1) The error at light load (not in excess of 10 per cent of the rated capacity of the meter).

(2) The error at heavy load (approximately 75 per cent, but not less than 60 per cent of the rated capacity of the meter, or in case the customer's connected load does not attain the latter value, the full connected load may be considered as heavy load for the purpose of this test).

(3) The average error of the meter shall then be computed by taking the algebraic average of the error at light load and the error at heavy load. [See also p. 175.]

RULE E-15. Meter accuracy.—(a) No watthour meter that has an incorrect register constant, gear ratio, or dial train, or which registers "creeps" on no load shall be placed in service or be allowed to remain in service without adjustment and correction.

(b) No watthour meter shall be placed in service which has not been tested for accuracy of registration and adjusted to meet these requirements:

Average error not in excess of 2 per cent.

Error at heavy load not in excess of 2 per cent.

Error at light load not in excess of 4 per cent.

Nothing in this rule shall be construed to prohibit the use of meters now in service where the error at light load may be in excess of 4 per cent slow; nor shall this rule be construed to prevent the use of meters the average error of which is not in excess of 2 per cent when tested in accordance with the methods of test employed by the commission.

(c) Alternating current service watthour meters which are to be used on circuits supplying primarily inductive load shall also be tested before installation at 100 per cent of rated current at 50 per cent lagging power factor and, if necessary, adjusted so that the error will not be in excess of 2 per cent under these conditions.

(d) Whenever a test made by the utility or by the commission on a service watthour meter connected in its permanent position in service shows the average error to be in excess of 2 per cent, the meter shall be adjusted to bring all the errors specified in paragraphs "b" and "c" within the specified limits.

DISTRICT OF COLUMBIA.

SEC. 2 (g).—After test a meter shall be adjusted by the electrical corporation so as to register with an error of not more than 1 per cent at light and full loads when compared with a working standard and so as to be without creep.

ILLINOIS.

RULE 10. Watthour meter accuracy requirements.—(a) On any test of a service watthour meter, the meter shall be left so adjusted that the error shall not be in excess of the following:

	Commutator and mercury types.	Induction type.
	Per cent.	Per cent.
Average error.....	2	2
Error at heavy load.....	1	1
Error at light load.....	4	3

This allowance of certain variations from correctness is specified to allow for the necessary irregularities in meter tests and maintenance conducted on a commercial scale. It is not the intent of the rule that meters may deliberately be set in error by the amount of tolerance.

(b) No watthour meter which is mechanically defective or which has incorrect constants shall be placed in service or be allowed to remain in service without adjustment and correction after such defect or inaccuracy has been discovered.

(c) No watthour meter which registers on "no load" shall be placed in service or allowed to remain in service in such condition after the creeping has been discovered. A meter creeps when, with all load wires disconnected, the moving element makes more than one complete revolution.

(d) Watthour meters installed with instrument transformers or shunts shall be tested as a unit with such transformers or shunts, unless the ratio of transformation of the transformers and the resistance of the shunts have been previously determined within ten years and are on file at the office of the utility for use in calculating the results of tests made. All such calibration tests must have been made by a laboratory of recognized standing, or by the utility, using suitable apparatus and methods.

RULE 11. *Demand meter accuracy requirements.*—(a) Demand meters when tested on the loads specified in rule 9 should be adjusted, if necessary, to meet the following requirements:

Curve drawing instruments:

Electrical element. Error should not exceed 2 per cent of full-scale indication.

Timing element. Error should not exceed $\frac{1}{4}$ per cent.

Integrated demand meters:

Electrical element. Error should not exceed that specified for watthour meters, rule 10.

Timing element. When used to measure time interval only, error should not exceed 2 per cent. When used also to keep a record of time of day at which the demand occurs, error should not exceed $\frac{1}{4}$ per cent.

Lagged demand meters:

Electromagnetic type. Error should not exceed 2 per cent of full-scale indication.

Thermal type. Error should not exceed 4 per cent of full-scale indication.

INDIANA.

RULE 12. *Method of determining average error of meters.*—The average error of a service watthour meter shall be determined as follows: The error at light load—here defined as approximately 10 per cent of the rated capacity of the meter—shall be determined by taking the average of at least two errors, determined from as many separate tests on the same light load, which errors must agree within one-half per cent.

In the same manner the error at heavy load—here defined as a load of approximately 75 per cent of the rated capacity of the meter—shall be determined.

The average error of the meter shall then be determined by taking an average of the error at light load and the error at heavy load, proper account being taken of the sign of these two errors: Provided, That where the consumer's connected load does not equal 75 per cent of the rated capacity of the meter, the full connected load may be considered as heavy load for the purpose of test.

RULE 13. *Meter accuracy.*—(a) *Creeping.*—No watthour meter which registers on "no load" when the applied voltage is less than 110 per cent of standard service voltage shall be placed in service or allowed to remain in service.

(b) *Initial accuracy requirements.*—No watthour meter shall be placed in service which is in any way mechanically defective or which has incorrect constants or which has not been tested for accuracy of measurement and adjusted, if necessary, to meet these requirements.

Average error not over 2 per cent plus or minus;

Error at heavy load not over 1 per cent plus or minus;

Error at light load not over 4 per cent plus or minus.

(c) *Test for correct lagging.*—Alternating current service watthour meters, which are to be used on circuits supplying inductive load shall also be tested before installation at 100 per cent of rated current at 50 per cent lagging power factor when practicable, and, if necessary, adjusted so that the error will not be more than 2 per cent plus or minus.

(d) *Adjustment after test.*—Whenever a test made by the utility or by the commission on a service watthour meter connected in its permanent position in place of service shows that the average error is greater than that specified above, the meter shall be adjusted to bring the average error within the specified limits.

(e) *Allowable error.*—A service watthour meter having an average error of not more than 4 per cent plus or minus, may be considered as correct and no adjustment of charges shall be entailed by such an error.

MARYLAND.

4. *Meter testing and accuracy.*—NOTE.—It is recommended that all electric service and the rates therefor be based upon the registration of an established type of watthour or other approved meter, and that flat rates be resorted to only when the conditions clearly do not justify a metered service.

(a) All meters shall be tested before installation and adjusted to the accuracy prescribed. No meter shall be placed in service unless its accuracy has been established and has been approved and marked with the established seal of the commission. No meter shall be placed, or allowed to remain in service without adjustment and correction: (1) That "creeps" under any commercial range of voltage; (2) that is in any way mechanically defective; or (3) that has an incorrect ratio or constant. No meter shall be placed in service that has an error in registration of more than 1 per cent; no meter shall be permitted to remain in service that has an error in registration of more than 2 per cent, when compared with approved working standards, as prescribed in General Rule E 2 (a). Adjustment of meters preparatory to placing in service shall not be consistently fast, but the allowable error must be construed as "leeway" in testing only.

(b) Before being placed in service, all meters shall be tested at "light" load and at "full" load. "Light" load shall be between 5 per cent and 10 per cent of rated capacity for induction type meters, and approximately 15 per cent of rated capacity for commutating type meters; "full" load is approximately 100 per cent of rated capacity. The adjustment to 1 per cent error prescribed in (a) shall be the result of at least two consecutive runs each at light and full load, which two runs must agree within one-half per cent. The condition of the meter shall be the average result of the tests at light and full load.

(c) Whenever on installation, periodic or any other tests, a meter is found to exceed 2 per cent error in registration, it must be adjusted so as to register correctly to within 1 per cent, when compared with approved working standards as prescribed in General Rule E 2 (a).

MICHIGAN.

25. *Accuracy of meters.*—No watthour meter which registers (creeps) at no load when the applied voltage is less than 110 per cent of standard "normal" voltage shall be placed in service or allowed to remain in service.

26. No watthour meter shall be placed in service which is in any way mechanically defective or which has incorrect constants or which has not been tested and adjusted to meet the following requirements:

Average error not over 2 per cent positive or negative.

Error at heavy load not over 1 per cent positive or negative.

Error at light load not over 3 per cent positive or negative.

27. Whenever a test made upon a service watthour meter connected in its permanent position at the point of service, shows an average error greater than specified in the preceding paragraph, the meter shall not be allowed to remain in service unless it shall be adjusted to bring the error within the specified limits.

MISSOURI.

RULE 3. The allowance of certain variations from correctness on meters as herein-after specified does not mean that meters may deliberately be set in error by the amount of the tolerance. This tolerance is specified to allow for the necessary irregularities in meter tests and maintenance conducted on a commercial scale.

RULE 31. Any electric-service meter tested on complaint or for any other reason after having been in service may be considered as having been recording within allowable limits of accuracy at any possible load if it is found to register within 4 per cent of correct registration when tested in accordance with the provisions of rule 29. After such test, however, the meter shall be adjusted for accuracy in accordance with the provisions of rule 29 [see p. 149] before being again placed in service.

It is suggested that the average accuracy of a meter in service be defined as follows, and that the condition of the meter as thus determined be used as a basis for adjusting consumer's bills for incorrect registration beyond certain limits where any utility makes such adjustments a part of its commercial practice:

Test an induction meter at approximately 5 per cent of rated capacity of meter, normal load, and 100 per cent of rated capacity of meter.

Test a commutator meter at approximately 10 per cent of rated capacity of meter, normal load, and 100 per cent of rated capacity of meter.

The average of the tests at light, normal, and heavy load here defined as the average accuracy or "condition" of meter shall be obtained by multiplying the result of the test at normal load by 3 and adding the results of the tests at light and heavy load and dividing the total by 5.

The normal load referred to shall be considered as the following percentage of full connected load for the classes of installation set forth, or classes similar thereto:

	Per cent.
A. Residence and apartment lighting.....	25
B. Elevator service.....	40
C. Factories (individual drive), churches, and offices.....	45
D. Factories (shaft drive), theaters, clubs, entrances, hallways, and general store lighting.....	60
E. Saloons, restaurants, pumps, air compressors, ice machines, and moving-picture theaters.....	70
F. Sign and show window lighting and blowers.....	100

When a meter is found to be connected to an installation consisting of two or more of the above classes of loads, the normal load shall be obtained by multiplying the connected watt load of each class by the percentage specified above and adding the results.

MONTANA.

RULE 24. *Meter accuracy.*—(a) A watthour meter in service having an average error of not more than four (4) per cent plus or minus, may be considered as correct and no adjustment of charge shall be required for such error, but the meter shall be adjusted in accordance with rule 22a.

RULE 22. Error.—(a) No watthour meter shall be placed or retained in service which is in any way mechanically defective or which has incorrect constants or which has not been tested for accuracy of measurement and adjusted if necessary to meet these requirements:

- Average error not over 2 per cent plus or minus;
- Error at heavy load not over 1 per cent plus or minus;
- Error at light load not over 4 per cent plus or minus.

(b) The average error of a service meter shall be determined as follows: The error at light load, here defined as approximately 10 per cent of the rated capacity, shall be determined by taking the average of at least two errors, determined from as many separate tests on the same light load, which errors must agree within one-half of 1 per cent. The error at heavy load shall be determined in the same manner, heavy load being here defined as a load of approximately 75 per cent of the rated capacity of the meter. The average error of the meter shall then be determined by taking an average of the error at light load and the error at heavy load, proper account being taken of the sign of the two errors: *Provided*, That where the consumers connected load does not equal seventy-five (75) per cent of the rated capacity of the meter, the full connected load may be considered as heavy load for the purpose of the test.

NEVADA.

RULE 15. No electric meter shall be placed in service nor allowed to remain in service which has an error of registration in excess of 2 per cent on normal operating load or 3 per cent on a load of one-tenth the rated capacity of the meter.

NEW HAMPSHIRE.

RULE 2. No electric service meter shall be allowed to remain in service which registers upon no load, has an incorrect gear ratio, register constant, test constant, or dial train, or which has an error in measurement in excess of 4 per cent at either light load, normal load, or heavy load.

NEW JERSEY.

No. 18. An electric meter may be considered correct when it does not show, in comparison with standards approved by the commission, an error which is greater than 4 per cent on the light load or heavy load.

Definition.—Light load shall be between 5 and 10 per cent of the rated capacity of the meter for an induction meter and between 10 and 15 per cent of the rated capacity of the meter for a commutator meter. Heavy load shall not be less than 60 per cent of full rated capacity of the meter.

RULE 19. The average accuracy of a meter shall be the average of the accuracy at light load and at heavy load as found above, but in all cases except residences where meter is found more than 4 per cent fast, tests shall be made at light load, at normal load, and full load, and the average of these tests shall be obtained by multiplying the result of the tests of the normal load by 3 and adding the results of the tests at light load and full load, and dividing the total by 5.

Definition.—The normal load shall be considered as the following percentage of full connected load:

	Per cent.
A. Residence and apartment lighting	25
B. Elevator service	40
C. Factories (individual drive), churches, and offices	45
D. Factories (shaft drive), theaters, clubs, entrances, hallways, and general store lighting	60
E. Saloons, restaurants, pumps, air compressors, ice machines, and moving-picture theaters	70
F. Sign and window lighting and blowers	100

NEW YORK.

SEC. 20. *Accuracy determination.*—The final average accuracy of complaint and office tests obtained by multiplying the result of the test at normal load by three, adding the results of the tests at 10 per cent capacity and 100 per cent capacity and dividing the total by five, shall be deemed the condition of the meter and such final average shall be reported to the commission on the form prescribed by it. For periodic tests the final average shall be determined as above for light, normal, and full loads. (See sec. 16.)

SEC. 21. Three tests shall be made at each load at which the meter is tested, but should any two fail to agree within 1 per cent, additional tests shall be made until three results are obtained which do not vary one from another more than 1 per cent.

SEC. 22. *Adjustment of watthour meters.*—All meters shall be adjusted so as to register with an error of not more than 1 per cent at 10 per cent and at 100 per cent capacity (light and full loads), and both of these adjustments shall be maintained in this condition as nearly as possible.

NORTH DAKOTA.

RULE 12. *Methods of determining average error of meters.*—(a) The average error of a service watthour meter shall be determined as follows: The error at light load—here defined as approximately 10 per cent of the rated capacity of the meter—shall be determined by taking the average of at least two errors, determined from as many separate tests on the same light load, which error must agree within one-half per cent.

(b) In the same manner the error at heavy load—here defined as a load of approximately 75 per cent of the rated capacity of the meter shall be determined.

(c) The average error of the meter shall then be determined by taking an average of the error at light load and the error at heavy load, proper account being taken of the sign of these two errors: *Provided*, That where the consumer's connected load does not equal 75 per cent of the rated capacity of the meter, the full connected load may be considered as heavy load for the purpose of test.

RULE 13. *Meter accuracy.*—(a) *Creeping.*—No watthour meter which registers on "no load" when the applied voltage is less than 110 per cent of standard service voltage shall be placed in service or allowed to remain in service.

(b) *Initial accuracy requirements.*—No watthour meter shall be placed in service which is in any way mechanically defective or which has incorrect constants or which has not been tested for accuracy of measurement and adjusted, if necessary, to meet these requirements.

Average error not over 2 per cent plus or minus;

Error at heavy load not over 1 per cent plus or minus;

Error at light load not over 4 per cent plus or minus.

(c) *Test for correct lagging.*—Alternating-current service watthour meters, which are to be used on circuits supplying inductive load shall also be tested before installation at 100 per cent, of rated current at 50 per cent lagging, power factor when practicable, and, if necessary, adjusted so that the error will not be more than 2 per cent, plus or minus.

(d) *Adjustment after test.*—Whenever a test made by the utility or by the commission on a service watthour meter connected in its permanent position in place of service shows that the average error is greater than that specified above, the meter shall be adjusted to bring the average error within the specified limits.

(e) *Allowable error.*—A service watthour meter having an average error of not more than 4 per cent plus or minus, may be considered as correct and no adjustment of charges shall be entailed by such an error.

OKLAHOMA.

RULE 13. Accuracy requirements for service watthour meters—(a) Mechanical adjustments.—No watthour meter that has an incorrect register constant, test constant, gear ratio, dial train, any other mechanical defect, or that registers upon no load (creeps) shall be placed in service or be allowed to remain in service without adjustment and correction. A meter in service creeps when, with all load wires disconnected, the moving element makes one complete rotation in 15 minutes or less.

(b) *Allowable error.*—No watthour meter that has an average error in registration of more than 2 per cent, or has an error in registration of more than plus 2 or minus 4 per cent at light load or plus or minus 2 per cent at heavy load, shall be placed in service or allowed to remain in service without adjustment and correction. Whenever on initial, installation, periodic, or any other tests a meter is found to exceed any one of these limits it shall promptly be adjusted and corrected.

Meters shall be adjusted as closely as possible to the condition of zero error. The allowance of certain variations from correctness is specified to allow for the necessary irregularities in meter tests and maintenance conducted on a commercial scale. It is not the intent of the rule that meters may be deliberately set in error by the amount of tolerance.

(c) *Meter test loads.*—Light load shall be 5 to 10 per cent of the rated capacity of the meter. Heavy load shall be not less than 60 per cent nor more than 100 per cent of the rated capacity of the meter.

(d) *Average error.*—In all tests made by the commission or utility the average error of a meter shall be determined by one or the other of the following methods:

Method A.—Take one-fifth of the algebraic sum of (1) the error at light load; (2) three times the error at normal load; (3) the error at full rated capacity.

In determining normal load the following percentages of the several classes of full-connected installations may be used:

	Per cent.
A. Residence and apartment lighting.....	25
B. Elevator service.....	40
C. Factory lighting, individual drives, churches, offices, stables, and hotels....	45
D. Factory shaft drive, theaters, clubs, hallways, entrances, and general store lighting.....	60
E. Saloons, restaurants, pumps, air compressors, and ice machines.....	70
F. Sign and window lighting, blowers, moving-picture machines.....	100

Method B.—Take one-half the algebraic sum of (1) the error at light load; (2) the error at heavy load.

RULE 14. Accuracy requirements for demand meters.—Demand meters must be adjusted to meet the following accuracy requirements on installation, periodic, or any other tests:

- (1) Curve-drawing instruments:

	Error shall not exceed—
Electrical element.....	2 per cent of full-scale deflection.
Timing element.....	$\frac{1}{4}$ per cent.
- (2) Integrated-demand meters:

Electrical element.....	Tolerances specified in rule 13.
Timing element.....	2 per cent demand interval.
	$\frac{1}{4}$ per cent, 24-hour interval.
- (3) Lagged-demand meters:

Electromagnetic type.....	2 per cent of full-scale deflection.
Thermal type.....	4 per cent of full-scale deflection.

OREGON.

See "Referee or commission tests—fees," under Oregon [p. 180].

PENNSYLVANIA.

NO. 11. *Allowable error.*—No watthour meter shall be placed in service nor allowed to remain in service, which registers at no load when the applied voltage is less than 110 per cent of standard service voltage, nor which is in any way mechanically defective, nor which has incorrect constants, nor an error in measurement in excess of 4 per cent.

NO. 12. *Method of determining the error.*—The error of a service watthour meter shall be determined as follows: The error at light load, here defined as not less than 5 per cent nor more than 10 per cent of rated capacity for induction type meters, and not less than 10 per cent nor more than 15 per cent of rated capacity for commutator-type and mercury-type meters, shall be determined by taking the average of at least two errors determined from as many separate readings of the same light load which errors must agree with each other within one-half per cent of registration accuracy. In the same manner the error at heavy load—here defined as not less than 75 per cent nor more than 100 per cent of rated capacity, shall be determined.

The error of the meter shall then be determined by taking the average of the error at light load and the error at heavy load, proper account being taken of the sign of these two errors: *Provided*, That where the consumer's connected load does not equal 75 per cent of the rated capacity of the meter, the full connected load may be considered as heavy load for purposes of test.

In all cases where it is not practicable to determine the error by the method outlined above, the utility shall have the option of installing an approved check meter or meters, and determining the error of the service meter by comparing the watthours registered by the check meter with the watthours registered by the service meter in the same time. When this option is exercised, the check meter shall be left in circuit until the hand on the first dial of the service meter shall have made at least two complete revolutions. If a utility desires to use "per cent registration," or "accuracy" in place of "per cent error," the per cent registration shall be determined in the same manner as provided above for determining per cent error.

SOUTH CAROLINA.

RULE 14. *Method of determining average error of meters.*—The average error of a service watthour meter shall be determined as follows: The error at light load—here defined as approximately 10 per cent of the rated capacity of the meter—shall be determined by taking the average of at least two errors, determined from as many separate tests on the same light load, which errors must agree within one-half per cent.

In the same manner the error at heavy load—here defined as a load of approximately 75 per cent of the rated capacity of the meter—shall be determined.

The average error of the meter shall then be determined by taking an average of the error at light load and the error at heavy load, proper account being taken of the sign of these two errors: *Provided*, That where the consumer's connected load does not equal 75 per cent of the rated capacity of the meter, the full connected load may be considered as heavy load for the purpose of test.

RULE 15. *Meter accuracy.*—(a) *Creeping.*—No watthour meter which registers on "no load" when the applied voltage is less than 110 per cent of standard service voltage shall be placed in service or allowed to remain in service.

(b) *Initial accuracy requirements.*—No watthour meter shall be placed in service which is in any way mechanically defective, or which has incorrect constants, or which has not been tested for accuracy of measurement and adjusted, if necessary, to meet these requirements:

Average error not over 2 per cent plus or minus;
 Error at heavy load not over 1 per cent plus or minus;
 Error at light load not over 4 per cent plus or minus.

(c) *Adjustment after test.*—Whenever a test made by the utility or by the commission on a service watthour meter connected in its permanent position in place of service shows that the average error is greater than that specified above, the meter shall be adjusted to bring the average error within specified limits.

(d) *Allowable error.*—A service watthour meter having an average error of not more than 4 per cent plus or minus, may be considered as correct, and no adjustment of charges shall be entailed by such an error.

WASHINGTON.

RULE 27. No electric meter shall be placed in service or allowed to remain in service which has an error of registration in excess of 4 per cent on one-tenth load or full load.

WEST VIRGINIA.

RULE 11. *Accuracy requirements for watthour meters.*—No watthour meter that has an error in registration of more than 2 per cent, plus or minus, at either light load or heavy load shall be placed in service. Whenever on installation, periodic or any other test, a meter is found to exceed these limits, it must be adjusted so as to register correctly to within 2 per cent, at light load and at heavy load, and to be without creep.

Definition of light and heavy load.—Light load shall be approximately 5 per cent of the rated capacity of the meter for alternating-current induction-type meters, and approximately 10 per cent of the rated capacity of the meter for commutator-type meters. Heavy load shall not be less than 60 per cent of the rated capacity of the meter for all types.

WISCONSIN.

RULE 15. No electricity meter shall be placed in service or allowed to remain in service which has an incorrect register constant, test constant, gear ratio, or dial train, or which has an error in measurement in excess of 4 per cent between one-tenth and full-connected load.

AUTHORIZATION AND APPLICATION OF RULES.

CALIFORNIA.

The following rules and regulations are hereby found to be just and reasonable rules and regulations, and are hereby established as rules and regulations to be obeyed and followed by all water, gas, electric, and telephone utilities doing business within California.

[In the matter of the practice of water, gas, electric, and telephone utilities requiring deposits before rendering service. Nov. 5, 1915.]

COLORADO.

RULE I. *Application of rules.*—(a) The following rules shall apply to any person, firm, corporation, or municipality now or hereafter engaged as a public utility in the business of furnishing gas, electricity, or water for domestic or commercial consumers within the State of Colorado.

(b) The adoption of these rules shall in no way preclude the commission from altering or amending same in whole or in part, or from requiring any other additional service, equipment, facility, or standard, either upon complaint or upon its own motion, or upon the application of any utility. Furthermore, these rules shall not in any way relieve any utility from any of its duties under the laws of this State.

CONNECTICUT.

Order B.—After due and legal notice given and public hearing had, as on file and record in the office of the commission will fully appear, and pursuant to the authority vested in this commission, we do hereby approve, adopt, establish, and issue the rules, regulations, and standards hereto attached, marked "Exhibit B," and entitled "Rules, Regulations, and Standards for Electric Companies," and

We do hereby require and direct each and every electric company within the definition of section 1 of chapter 128 of the Public Acts of 1911 to adopt and put into effect said rules, regulations, and standards on and after the 1st day of August, 1915: Provided, however, That no provision of said rules, regulations, and standards shall be construed to prevent any such electric company from making a special contract with any customer involving quality or service conditions at variance with those hereby established, and provided further, that said rules may be modified by the commission, as applicable to any particular company, upon petition and proof that it is impracticable for such company under its financial or operating conditions to comply with certain designated provisions thereof.

Nothing in this order establishing rules, regulations, and standards shall be construed to be within the penal provisions of said chapter 128 of the Public Acts of 1911, unless and until the commission shall issue a further order in the premises, directed to any or all such electric companies, fixing by mandatory order the initial efficiency of electric lamps furnished by such companies, the voltage at which electricity shall be distributed, or any other specific requirement of said rules, regulations, and standards subject to such an order.

A failure, however, on the part of any such electric company to comply with the rules, regulations, and standards hereby established (or as the same may be hereafter modified as applicable to any particular company) shall be *prima facie* evidence against such company that the operation or service involved is not of the standard required by the Public Utilities Commission of the State of Connecticut.

DISTRICT OF COLUMBIA.

ORDERED.—(1) That, under the authority of section 8 of the District of Columbia appropriation act, approved March 4, 1913, creating the Public Utilities Commission, the following regulations for electric service in the District of Columbia be, and the same are hereby, made and prescribed, and obedience thereto and compliance therewith are hereby required of and enjoined upon all corporations and persons furnishing electric service in the District of Columbia, their officers, agents, and employees.

(2) That, on application to the commission and for sufficient cause shown, such modifications and exemptions may be made with reference to these regulations as the facts in each case shall warrant. Noncompliance with any of these regulations will constitute a violation of the law unless such noncompliance is specifically authorized by an order of the commission.

(3) That the department of this commission which has charge of the supervision of electric service be called the Electrical Inspection Bureau.

(4) That these regulations shall take effect February 15, 1915, and shall continue in force until changed or abrogated by further order of the commission.

INDIANA.

RULE 2. Authorization of rules.—In accordance with statutory provisions in sections 36, 37, and 110 above, the attached rules establishing standards for electric service have been prepared, approved by the commission and become effective on May 1, 1920.

RULE 3. Application of rules.—These rules shall apply to any public utility defined as such by the Indiana Public Service Commission law, which is now or hereafter

may be engaged in the production, sale or distribution of electric service and which comes under the jurisdiction of the commission.

RULE 4. *Saving clause.*—The adoption of these rules shall in no way preclude the commission from altering or amending the same, in whole or in part, or from requiring any other or additional service, equipment, facility or standards, either upon complaint or upon its own motion, or upon the application of any utility; and, further, these rules shall in no way relieve any utility from any of its duties under the laws of this State.

ILLINOIS.

II. *Authorization of rules.*—In accordance with the statutory provisions in paragraph 54 above, the attached rules for electric service have been prepared and are approved by the commission to be effective on January 1, 1921.

III. *Application of rules.*—These rules shall apply to any public utility which is defined as such by the Illinois public utilities commission law which is now or hereafter may be engaged in the production, sale, or distribution of electricity and which comes under the jurisdiction of the commission.

IV. *Applications for exemptions.*—Where compliance with any rule or rules can not be effected the utility shall notify the commission in writing within 30 days after the circumstances arise which make it impossible to comply and shall make a satisfactory showing why it is unable to comply with said rule or rules. Failure on the part of utility to make application for such exemption where compliance can not be effected shall receive serious consideration by the commission in any subsequent issue involving rates or service in the territory affected.

V. *Saving clause.*—The adoption of these rules shall in no way preclude the commission from altering or amending the same in whole or in part, or from requiring any other or additional service, equipment, facility, or standard, either upon complaint upon its own motion or upon the application of any utility; and, furthermore, these rules shall in no way relieve any utility from any of its duties under the laws of this State.

If any utility has been supplying or is under contract to supply a quality of service of greater value to the consumer than that which these rules require, no reduction in such quality of service shall be made by the utility before a determination by the commission of the proper rate to be charged the consumer for the lower grade of service. Such a rate shall, in general, be based upon the cost of furnishing the grade of service required by these rules.

MARYLAND.

Application of rules.—The following rules shall apply to all persons, firms, associations, or corporations, both private and municipal, now or hereafter engaged as a public utility in the business of furnishing electric energy to domestic or commercial consumers within the State of Maryland, except as hereinafter provided. The adoption of these rules shall in no way preclude the commission from altering or amending the same, in whole or in part, or from requiring any other or additional service, equipment, facility, or standard, either upon complaint or upon its own motion, or upon the application of any utility. And, furthermore, these rules shall not in any way relieve any utility from any of its duties under the laws of this State, except as hereinafter provided.

MICHIGAN.

1. *Scope and application.*—These rules apply to the methods and conditions of service employed by all public utilities whether privately or municipally owned.

2. *Qualifying clause.*—The adoption of these rules shall in no way prevent the commission from altering or amending the same, in whole or in part, or from requiring any other or additional service, appliances, or standards, either upon its own motion or upon the application of any consumer or utility.

3. *Reference to commission.*—In any case where the parties concerned shall fail to agree upon the application or interpretation of any of these rules, or in case of disagreement regarding regulations promulgated by any utility concerning service, the matter may be referred by either party to the commission for settlement.

MISSOURI.

RULE 1. The following rules shall apply to all gas corporations, electric corporations, water corporations, and municipalities, as these terms are defined in the public-service commission law, engaged in the business of furnishing gas or electricity for light, heat, or power, or supplying water for domestic or commercial uses within the State of Missouri.

MONTANA.

RULE 2. Application of rules.—(a) These rules shall apply to any person, firm, or corporation which is now or may hereafter become engaged as a public utility in the business of selling electric current to domestic, commercial, or industrial consumers within the State of Montana.

(b) The rules are intended to define good practice which can normally be expected. They are intended to insure adequate service and prevent unfair charges to the public, and to protect the utilities from unreasonable demands. The cooperation of the utilities with the commission is presupposed.

(c) In any case where compliance with any of these rules introduce unusual difficulty, such rule may be temporarily waived by the commission upon application of the utility. If in such case compliance with the rule would cost more than the results of such compliance are worth to the public and electric consumers it may be permanently set aside by the commission.

NORTH DAKOTA.

RULE 2. Authorization of rules.—In accordance with statutory provisions in sections 5 and 9 above, the attached rules establishing standards for electric service have been prepared, approved by the commission after public hearing, and become effective on the first day of the month of June, 1920.

RULE 3. Application of rules.—These rules shall apply to any public utility defined as such by the law governing the regulation of public utilities by the Board of Railroad Commissioners of the State of North Dakota, being chapter 192—house bill 97 of the acts of the sixteenth session of the legislative assembly of the State of North Dakota, 1919, which is now or hereafter may be engaged in the production, sale, or distribution of electric service and which comes under the jurisdiction of the commission.

RULE 4. Saving clause.—The adoption of these rules shall in no way preclude the commission from altering or amending the same, in whole or in part, or from requiring any other additional service, equipment, facility, or standards, either upon complaint or upon its own motion, or upon the application of any utility; and, further, these rules shall in no way relieve any utility from any of its duties under the laws of this State.

OKLAHOMA.

RULE 2. Application of rules.—(a) These rules shall apply to all corporations, associations, companies, individuals, their trustees, lessees or receivers, successors or assigns, except cities, towns, or other bodies politic, which are now or may hereafter become engaged as a public utility in the business of transmitting, producing, delivering, or furnishing electric current for light, heat, or power within the State of Oklahoma.

(b) These rules are intended to define good practice which can normally be expected. They are intended to insure adequate service and prevent unfair charges to the public and to protect the utilities from unreasonable demands.

(c) In any case where compliance with these rules introduces unusual difficulties, such rule may be temporarily waived by the commission upon application of the utility. If, in such case, compliance with the rule would cost more than the results of such compliance are worth to the public and electric consumers, it may be permanently set aside by the commission.

(d) It is recommended that all city officials in the State require that the property owners and electrical consumers, under city jurisdiction, construct, install, maintain, and operate their electrical house-wiring installations strictly in accordance with the requirements of the current edition of the National Electrical (Fire) Code. For the protection of the consumer, it is recommended that all wiring be inspected by an authorized official or competent electrical inspector before notification is given the company that the consumer is ready for service.

RULE 3. *Application for exemptions.*—Where compliance with any rule or rules can not be effected, the utilities shall notify the commission in writing within 30 days after the circumstances arise which make it impossible to comply and shall make a satisfactory showing why it is unable to comply with said rule or rules. Failure on the part of a utility to make application for such exemption where compliance can not be effected shall receive serious consideration by the commission in any subsequent issue involving rates or service in the territory affected.

RULE 4. *Saving clause.*—The adoption of these rules shall in no way preclude the commission from altering or amending the same, in whole or in part, or from requiring any other or additional service, equipment, facility, or standard, either upon complaint, upon its own motion, or upon the application of any utility; and, furthermore, these rules shall in no way relieve any utility from any of its duties under the laws of this State.

OREGON.

RULE 1. *Application of rules: Definitions.*—(a) The adoption of these rules and standards shall not preclude the commission from altering or amending the same in whole or in part, or from requiring any other or additional service, equipment, facility, or standards, either upon complaint or upon its own motion, or upon the application of any utility.

(b) The following rules shall apply to any person, firm, or corporation now or hereafter engaged in the business of furnishing gas or electricity for light, heat, or power, or supplying water for domestic or commercial uses within the State of Oregon as a public utility.

SOUTH CAROLINA.

RULE 1. *Authorization of rules.*—(a) Section 923 of article 16, of Chapter XIX, Volume I, of Code of Laws of South Carolina 1912, as amended March 24, 1922, provides: "That the Railroad Commission is hereby, to the extent granted, vested with power and jurisdiction to supervise and regulate the rates and service of every public utility in this State as defined in this act, together with the power, after hearing, to ascertain and fix such just and reasonable standards, classifications, regulations, practices, and measurements of service to be furnished, imposed, observed, and followed by every public utility in this State as defined in this act, and the State hereby asserts its rights to regulate the rates and services of every public utility as herein defined."

In accordance with the above provisions, the Railroad Commission has adopted the following rules and fixed the following standards for electric service, to become effective the first day of October, 1922. All previous rules or standards conflicting with those contained herein are hereby superseded.

(b) The adoption of these rules shall in no way preclude the Railroad Commission from altering or amending them in whole or in part, or from requiring any other or additional service, equipment, facility, or standard, either upon complaint, or upon its own motion, or upon the application of any utility. Furthermore, these rules shall not in any way relieve any utility from any of its duties under the laws of this State.

RULE 2. Application of rules.—(a) These rules shall apply to any person, firm, or corporation (except municipalities, or agents thereof) which is now or may hereafter become engaged as a public utility in the business of furnishing electric current for domestic or commercial consumers within the State of South Carolina.

(b) The rules are intended to define good practice which can normally be expected. They are intended to insure adequate service and prevent unfair charges to the public, and to protect the utilities from unreasonable demands. The cooperation of the utilities with the commission is presupposed.

(c) In any case where compliance with any of these rules introduces unusual difficulty, such rule may be temporarily waived by the commission upon application of the utility. If in such case compliance with the rule would cost more than the results of such compliance are worth to the public and consumers of electric current, it may be permanently set aside by the commission.

RULE 3. Definition.—In the interpretation of these rules, the word "commission" shall be taken to mean the Railroad Commission of South Carolina; the word "utility" shall be taken to mean any person, firm, corporation, except municipality, or agent thereof, engaged in the business of supplying electric current to domestic, commercial, or industrial users within this State; and the word "consumer" shall be taken to mean any person, firm, corporation, municipality, or other political subdivision of the State supplied by any such utility.

WASHINGTON.

RULE 1. The following rules shall apply to any person, firm, or corporation now or hereafter engaged in the business of furnishing gas or electricity for light, heat, or power or supplying water for domestic or commercial uses within the State of Washington. The word "company" used in these rules shall be construed to mean any person, firm, or corporation engaged in the business designated. The word "commission" used in these rules shall be construed to mean the Public Service Commission of Washington.

WEST VIRGINIA.

RULE 1. (b) The adoption of these rules and regulations shall not preclude the commission from altering or amending the same in whole or in part, or from requiring any other or additional service, equipment, facility, or standards, either upon request, or upon its own motion, or upon the application of any utility. These rules shall not in any way release any utility from any of its duties under the laws of this State.

(c) All existing construction dangerous to life or property should be changed to conform to suitable standards so as to obviate such danger as far as possible, and all reconstruction necessary to conform to the standards herein prescribed should be made as rapidly as practicable. Every utility shall report to the commission from time to time the progress of this work.

COMMISSION INSPECTIONS, TESTS, AND LABORATORY.³³

MISSOURI.

RULE 5. It is suggested that those utilities not required to maintain certain testing equipment as hereinafter specified arrange to perform the tests set forth by making use of the testing equipment of some near-by utility required to maintain same. Com-

³³ See also p. 175, "Referee tests."

plete equipment for all tests specified will be maintained at the laboratories of the State University at Columbia, Mo. The engineering laboratories of the State University will be prepared to standardize all testing equipment submitted for a nominal fee.

NEW HAMPSHIRE.

RULE 7. The commission will, from time to time, test such meters of each utility as it shall judge expedient. Under the provisions of section 2 of chapter 124 of the laws of 1913 a fee of 50 cents will be collected from the utility for each meter so tested with a voltage rating not exceeding 250 volts and a current capacity not exceeding 25 amperes, and for each meter of greater capacity a fee equal to the cost to the commission of testing the same.

RULE 16. The commission will, from time to time, inspect the works and systems of each utility, and the manner in which each such utility conforms to the rules and regulations herein contained. Under the provisions of section 2 of chapter 124 of the laws of 1913 a fee of not more than \$15 will be collected by the commission from the utility for each such inspection. In any case where the character of service is such as to require extended investigation a fee sufficient to cover the cost thereof to the commission will be collected.

WASHINGTON.

RULE 2. The commission shall designate two or more laboratories where the tests called for by these rules other than those tests to be made by the companies shall be made, and will appoint inspectors under whose direction the tests shall be made at the several laboratories so designated, or elsewhere as near as practicable to the locality where the test is desired.

COMPLAINTS.

CONNECTICUT.

RULE 10. *Complaints.*—(a) Each utility shall make full and prompt investigation of all complaints made to it at the office or in writing by its customers, either directly or through the commission, and it shall keep a file of all substantial complaints which shall show the name and address of the complainant and the adjustment or disposal made thereof.

COLORADO.

RULE 8. *Complaints.*—Each utility shall make a full and prompt investigation of all complaints made to it by its consumers, either directly or through the commission, and it shall keep a record of all written complaints received, which shall show the name and address of the complainant, the date and character of the complaint, and the adjustment or disposal made thereof. This record shall be open at all times to the inspection of the duly authorized representatives of this commission.

ILLINOIS.

RULE 5. *Complaints.*—(a) A full and prompt investigation shall be made of each complaint received. The word "complaint" as used in this rule shall be construed to mean substantial objection made to a utility as to its charges, facilities, or service. All written complaints shall be acknowledged in writing.

(b) A record shall be kept of each complaint showing the name and address of the complainant, the time of day and date received, the nature of the complaint, the result of the investigation, when and by whom conducted, and the final disposal of the complaint, with the time of day and date. The name and address of the complainant and the time of day and date received and nature of the complaint shall be recorded at the time the complaint is made.

INDIANA.

RULE 7. *Complaints, record of.*—Each utility shall keep a record of all written complaints received at its office in regard to service, which record shall include the name and address of the consumer, the date, nature of complaint, and the remedy. The record shall be available for inspection by duly accredited representatives of the commission.

MARYLAND.

I. *Complaints.*—Each utility shall make a full and prompt investigation of all complaints made to it by its consumers, either directly or through the commission, and it shall keep a record of all complaints received, which shall show the name and address of the complainant, the date and character of the complaint and the adjustment or disposal made thereof. These records shall be open at all times to the inspection of an authorized representative of the commission.

MICHIGAN.

6. *Complaints.*—There shall be kept by each utility a record of all formal complaints received at its offices in regard to service. The record shall contain the name and address of the consumer, class of service rendered, date and description of complaint, and nature and date of remedy applied.

MONTANA.

RULE 29. *Complaints.*—Each utility shall keep a record of complaints made to it by its consumers in a suitable book or file retained for that purpose; the record shall show the name and address of the complainant, the date and character of the complaint, and the adjustment or disposal made thereof.

NEW HAMPSHIRE.

RULE 17. Each utility shall keep a record of all complaints in regard to service, which shall include the name and address of the consumer, the date, the nature of the complaint, and the date and method of disposition.

NEW JERSEY.

No. 8. Each utility shall keep a record of complaints received at its office in regard to service, which shall include the name and address of the customer, the date, nature of complaint, and the remedy. The record shall be available for inspection at any time within one year by duly accredited representatives of the Public Utility Commission.

NORTH DAKOTA.

RULE 7. *Complaints, record of.*—Each utility shall keep a record of all written complaints received at its office in regard to service, which record shall include the name and address of the consumer, the date, nature of complaint, and the remedy. The record shall be available for inspection by duly accredited representatives of the commission.

OKLAHOMA.

RULE 33. *Record of complaints as to service.*—(a) A full and prompt investigation shall be made of each complaint received. The word "complaint" as used in this rule shall be construed to mean substantial objection made to a utility as to its charges, facilities, or service. All written complaints shall be acknowledged in writing.

(b) Each utility shall keep a record of all written complaints received at its office in regard to service, which record shall include the name and address of the consumer, the date, nature of complaint, and the remedy. The record shall be available for

inspection at any time within six months by duly accredited representatives of the commission.

(c) Each complainant who has a complaint to make regarding service, charges, or facilities of the utility, such complaint being of a nature that will permit time for correspondence without incurring serious trouble to the consumer, shall make such complaint in writing to the utility, before making complaint to the commission.

OREGON.

RULE 10. Complaints.—Each utility shall make a full and prompt investigation of all complaints made to it by its customers either directly or through the commission, and it shall keep a record of all complaints, which shall show the name and address of complainant, the date and character of the complaint, and the adjustment or disposition made thereof. The information contained in such record shall be furnished the commission upon its request.

PENNSYLVANIA.

No. 6. Complaint records.—Each utility shall keep a record of all written complaints received from its consumers in regard to service, which record shall show the name and address of the complainant, the date and nature of the complaint, the action taken, and the date of final disposition of the matter. These records shall be kept as specified in rule 10.

SOUTH CAROLINA.

RULE 9. Complaints.—Each utility shall make a full and prompt investigation of all service complaints made to it by its consumers, either directly or through the commission. It shall keep a record of all such complaints received, which record shall show the name and address of the complainant, the date and character of the complaint, and the adjustment or disposal made thereof.

WASHINGTON.

RULE 12. Each company furnishing gas, electric current, or water shall keep a record of all complaints made to it by its consumers, which record shall include the name and address of the consumer, the date, a statement of the complaint, and a statement of what the company did in reference thereto; and such information shall be furnished to the commission upon request.

WEST VIRGINIA.

RULE 29. Record of complaints as to service.—Every utility shall keep a record of all complaints received at its office in regard to service, including the name and address of the consumer, the date, nature of complaint, and the action taken. This record shall be available for inspection at any time within one year by any representative of the commission.

CREEPING METERS.

ARIZONA.

RULE 12. No electric meter which registers upon "no load" shall be placed in service or allowed to remain in service.

COLORADO.

See Accuracy requirements, p. 53.

DISTRICT OF COLUMBIA.

See Accuracy requirements, p. 54.

ILLINOIS.

See Accuracy requirements, p. 54.

INDIANA.

See Accuracy requirements, p. 55.

MARYLAND.

See Accuracy requirements, p. 56.

MICHIGAN.

See Accuracy requirements, p. 56.

MISSOURI.

RULE 30. No electric service watthour meter shall be allowed in service which has incorrect constants or dial train, or which creeps at no load when maximum service voltage under which meter operates is applied, or which is in any way mechanically defective.

MONTANA.

24. (b) No watthour meter which registers on "no load" when the applied voltage is less than 110 per cent of standard service voltage shall be allowed to remain in service.

NEVADA.

RULE 14. No electric meter which registers upon "no load" shall be placed in service, or allowed to remain in service.

NEW HAMPSHIRE.

See Accuracy requirements, p. 58.

NEW JERSEY.

No. 20. No electric meter which registers upon no load shall be placed in service or be allowed to remain in service.

NEW YORK.

SEC. 23. Determination of creep.—A watthour meter shall be considered to be creeping when on no load the disk rotates at the rate of one revolution in five minutes or less. The observation shall be made with all house wires removed from the meter and with no current flowing in the consumer's circuit. All meters in service shall be left without creep.

OKLAHOMA.

See Accuracy requirements, p. 60.

OREGON.

RULE 24. Defective meters.—(a) No electricity meter shall be placed in service or allowed to remain in service which registers upon no load, or which has an incorrect register constant, gear ratio, or dial train.

PENNSYLVANIA.

See Accuracy requirements, p. 61.

WASHINGTON.

No. 26. No electric meter which registers upon no load shall be placed in service or be allowed to remain in service.

WEST VIRGINIA.

See Accuracy requirements, p. 62.

WISCONSIN.

No. 14. No electric meter which registers upon no load shall be placed in service or allowed to remain in service.

DEFINITIONS.

COLORADO.

RULE 2. Definitions.—(a) The word "utility" as used in these rules shall be construed to mean any person, firm, or corporation engaged as a public utility, either municipally or privately owned, in the business of furnishing gas, electricity, or water for domestic or commercial consumers within the State of Colorado.

(b) The word "commission" as used in these rules shall be construed to mean the Public Utilities Commission of the State of Colorado.

(c) The word "consumer" as used in these rules shall be construed to mean any person, firm, or corporation supplied by any utility with gas, electricity, or water.

CONNECTICUT.

Definitions.—(a) The word "utility" as used in these rules shall be construed to mean any "electric company" as defined in section I, chapter 128, Public Acts of 1911.

(b) The word "commission" as used in these rules shall be construed to mean the Public Utilities Commission of the State of Connecticut.

(c) The word "customer" as used in these rules shall be construed to mean any person, company, firm, or corporation supplied by any utility with electrical energy.

ILLINOIS.

VI. Definitions.—The word "utility," when used in these rules, means any electric public utility as defined by the public utilities law.

The word "commission," when used in these rules, means the public utilities commission of the State of Illinois.

The word "consumer," when used in these rules, means any person, firm, or corporation supplied by any public utility with electricity.

The word "city," when used in these rules, includes all cities, villages, and incorporated towns.

INDIANA.

RULE 5. Definitions.—The word "utility," used in these rules, shall be construed to mean public utility. The word "commission," used in these rules, shall be construed to mean the State Public Service Commission of Indiana. The word "consumer" shall be taken to mean any person, firm, corporation, municipality, or other political subdivision of the State supplied by any such utility.

MARYLAND.

B. Definitions.—The word "commission" used in these rules shall be construed to mean the Public Service Commission of Maryland.

The word "consumer" used in these rules shall be construed to mean any person, firm, association, or corporation, either private or municipal, supplied with electric energy by any public utility.

The word "utility" used in these rules shall be construed to mean any public utility referred to in the first paragraph (A).

MICHIGAN.

4. *Definitions.*—For the purpose of these rules the following definitions apply:

(a) The word "commission" shall be construed to mean the Michigan Public Utilities Commission.

(b) The word "utility" shall be construed to mean public utility.

(c) The word "consumer" shall be construed to mean any person, firm, corporation, municipality, or other political subdivision of the State of Michigan or of the United States supplied by any utility.

(d) The term "line extension" shall be interpreted as including the poles, cross arms, and attachments, guys and anchors, wires, insulators, and pins, which are necessary for delivering the required secondary or primary (low tension) service to the premises of the consumers concerned, beginning at the nearest convenient point of connection to a previously existing secondary or primary (low tension) line and ending at the point where the service connection is made to the premises of the consumer farthest from the point of connection; but not including transformers and allied apparatus where such become necessary.

(e) The term "service connection" shall be interpreted as including a single span (or its equivalent in underground construction) strung from the entrance on the consumer's premises to a pole of a line extension adjacent.

(f) The term "flat rate" shall be interpreted as meaning any method of charge for electrical service, which is based entirely upon the consumer's installation of energy-consuming devices or upon a fixed sum per consumer.

MISSOURI.

RULE 1. The word "utility" when used in these rules shall be construed to mean any gas corporation, electricity corporation, water corporation, or municipality engaged in the designated business. The word "commission" when used in these rules shall be construed to mean the Public Service Commission of Missouri.

MONTANA.

RULE 3. Definition.—In the interpretation of these rules the word "commission" shall be taken to mean the Public Service Commission of Montana; the word "utility" shall be taken to mean any corporation, both public and private, company, individual, association of individuals, their lessees, trustees, or receivers appointed by any court whatsoever, engaged in the business of supplying energy in the form of electric current to domestic, commercial, or industrial users within this State; and the word "consumer" shall be taken to mean any person, firm, corporation, municipality, or other political subdivision of the State supplied by any such utility.

NEW HAMPSHIRE.

RULE 1. In the interpretation of these rules "commission" shall be taken to mean the Public Service Commission; "utility" shall be taken to mean any public utility engaged in supplying electric energy to the public, or supplying current to such utility; "lighting hours" shall be taken to mean the hours between sunset and 10.30 p. m.; "light load" shall be taken to mean any load not less than 4 nor more than 10 per cent of the rated capacity of the meter; "normal load" shall be taken to mean the percentage of the connected load according to the following classification:

	Per cent.
Residence and apartment lighting.....	25
Elevator service.....	40
Factories (individual drive), churches, and offices.....	45
Factories (shaft drive), theaters, clubs, entrances, hallways, and general store lighting.....	60

	Per cent.
Saloons, restaurants, pumps, air compressors, ice machines, and moving-picture theaters.....	70
Sign and window lighting and blowers.....	100
and "heavy load" any load not less than 60 per cent of the rated capacity of the meter.	

In determining the percentage error of a meter under rules 5, 6, and 7, the meter shall be tested at light load, normal load, and heavy load.

The average of these tests, obtained by multiplying the error at normal load by 3, adding (algebraically), the error at light load and heavy load and dividing the total by 5, shall be deemed as the average error of the meter, and such final average shall be used in calculating the amount of the refund should it exceed 4 per cent.

NORTH DAKOTA.

RULE 5. Definitions.—(a) The word "utility," used in these rules, shall be construed to mean public utility.

(b) The word "commission," used in these rules, shall be construed to mean The Board of Railroad Commissioners of the State of North Dakota.

(c) The word "consumer" shall be taken to mean any person, firm, corporation, municipality, or other political subdivision of the State of North Dakota supplied by any such utility.

OKLAHOMA.

RULE 5. Definitions and general provisions.—(a) In the interpretation of these rules, the word "commission" shall be taken to mean the Corporation Commission of Oklahoma.

(b) The word "utility" shall be taken to mean and include all corporations, associations, companies, individuals, their trustees, lessees or receivers, successors or assigns, except cities, towns or other bodies politic that now or hereafter may own, operate, or manage any plant or equipment, or any part thereof, directly or indirectly, for public use, for the production, transmission, delivery, or furnishing electric current for light, heat, or power.

(c) The word "consumer" shall be taken to mean any person, firm, corporation, municipality, or other subdivision of the State supplied by any such utility. The party who has signed the contract for service shall be considered the consumer in all cases where questions arise regarding service, charges, facilities of the company, refunds, prorated bills, tampering with company's equipment, fraudulent use of energy, etc., or in any other case where it becomes necessary to designate the particular party who is the consumer. The party who signs the contract for service shall be considered the consumer at the particular location designated in said contract until the contract has been cancelled.

(d) Any utility may decline to serve a consumer or prospective consumer until he has complied with the State and municipal regulations on electric service and the reasonable rules and requirements of the utility furnishing the service.

(e) If any utility has been supplying or is under contract to supply a quality of service of greater value to the consumer than that which these rules require, no reduction in such quality of service shall be made by the utility before determination by the commission of the proper rate to be charged the consumer for the lower grade of service. Such a rate shall, in general, be based upon the cost of furnishing the grade of service required by these rules.

OREGON.

RULE 1. (c) The word "utility" used in these rules shall be construed to mean any person, firm, or corporation engaged in such business.

(d) The word "commission" used in these rules shall be construed to mean the Railroad Commission of Oregon.

(e) The word "customer" used in these rules shall be construed to mean any person, company, firm, or corporation supplied by any utility with gas, electricity, or water.

PENNSYLVANIA.

Definition.—The term "utility" as used in these rules is here defined as meaning all public-service companies, corporations, and persons, as defined in the public-service company law, engaged in the production, sale, or distribution of electricity within the jurisdiction of the commission.

WEST VIRGINIA.

RULE 1. *Definitions and general provisions.*—(a) In the interpretation of these rules, the word "commission" means the Public Service Commission of West Virginia, and the word "utility" means all persons, association of persons, firms, corporations, municipalities, and agencies engaged in the business of generating, furnishing, distributing, and selling electricity, or using electricity for any public purpose. These rules shall not apply to telephone or telegraph utilities.

The word "consumer" shall be taken to mean any person, firm, corporation, or municipality supplied by any such utility.

DEPOSITS TO INSURE PAYMENT OF BILLS.

CALIFORNIA.

RULE 1. A water, gas, electric, or telephone utility may, under uniform nondiscriminatory rules and regulations, require that an applicant for metered or measured service establish his credit before service is delivered, unless a prepayment device makes such procedure unnecessary. The applicant's credit will be deemed established if he (1) owns the premises; or (2) makes a cash deposit; or (3) furnishes a guarantor for the payment of his bills, satisfactory to the utility; or (4) has paid all his bills to the utility promptly during the 12 months prior to the effective date of the order herein.

RULE 2. If an applicant for metered or measured service makes a cash deposit to insure payment for service to be delivered, the amount of the deposit shall be such as may be specified in the utility's rules, but in no event in excess of twice the average periodic bill of consumers of his class; provided, that the deposit for domestic or residence monthly service of water, gas, electric, and telephone utilities shall not exceed \$2.50, except that where the average of the monthly bills of those consumers of any class of domestic or residence service who make deposits is in excess of \$2 such consumers may be called upon to make deposits of uniform amount not exceeding twice such average.

RULE 3. If a consumer who has initially established his credit by showing that he is the owner of the premises, or by supplying a guarantor satisfactory to the utility, or by paying all his bills to the utility promptly during the 12 months prior to the effective date of the order herein, later fails to pay his bills, the utility may demand as guaranty for the payment of future bills a cash deposit in the amount provided in rule 2; provided, that service may not be discontinued for failure to make such deposit until the time specified in rule 5 hereinafter, notice of intention to discontinue service unless such demand is complied with.

RULE 4. If a consumer who has made a cash deposit fails to pay a bill for metered service, the utility may apply the deposit in so far as necessary to liquidate the bill and may require that the deposit be restored to its original amount; provided, that service may not be discontinued until the deposit has been fully absorbed, and in no event until the expiration of the respective periods of time after notice of intention so to do, as specified in rule 5, herein.

B. UNMETERED SERVICE.

RULE 8. A water, gas, electric, or telephone utility delivering unmetered service at flat rates may under uniform, nondiscriminatory rules and regulations, require payment in advance of delivery, for a period not to exceed that for which bills are regularly rendered as specified in the rate schedule, but may not demand guaranties to secure payment for service, to be rendered in the future.

C. RETURN OF DEPOSITS.

RULE 10. After a cash deposit to guarantee payment for metered or measured service has stood unimpaired for 12 months, it shall be returned to the depositor. Upon closing any account the balance of any deposit remaining after the closing bill for service has been settled shall be returned promptly to the depositor.

RULE 11. Interest at the rate of 6 per cent per annum must be paid by each water, gas, electric, or telephone utility on all deposits held by it to secure the payment of bills for metered service: *Provided*, That interest need not be paid if the service is discontinued within less than 12 months from the date of first taking service.

(a) Within 30 days after the effective date of this supplemental order, each water, gas, electric, and telephone utility shall return to the depositor all deposits heretofore made to guarantee payment for flat rate service, and deposits made to guarantee payment for metered or measured service by customers who have paid all their bills promptly during the 12 months prior to the effective date of this supplemental order, and (b) within 30 days after demand, each water, gas, electric, and telephone utility shall return all deposits made to guarantee payment for metered or measured service to customers who have paid all their bills promptly during the period of service, in cases in which the service has lasted less than 12 months: *Provided*, That such customers shall show ownership of the premises or shall offer guarantors satisfactory to the utility; except that if the utility so desires it may apply the existing deposit against current bills until the deposit is absorbed.

COLORADO.

RULE 11. (b) Any utility may require at any time from any consumer or prospective consumer a cash deposit intended to guarantee payment of current bills. Such required deposit shall not exceed the amount of an estimated 90 days' bill of such consumer, or in the case of a consumer whose bills are payable in advance, it shall not exceed an estimated 60 days' bill for such consumer. Interest shall be paid by the utility upon such deposits at the rate of 6 per cent per annum, payable upon the return of the deposit, or annually upon request of the consumer, for the time such deposit was held by the utility and the consumer was served by the utility, unless such period be less than six months: *Provided, further*, That the rate of interest on such cash deposits shall be only 4 per cent per annum if the utility keep such cash deposits in a separate and distinct trust fund and deposited as such in some bank or trust company, and not used by the utility in the conduct of its business. Interest payments may, at the option of the utility, be made either in cash, or by a credit to the consumer's account. In computing interest no consideration need be given to fractional parts of months or dollars.

(c) Each utility having on hand such deposits from consumers, or hereafter receiving such deposits from consumers, shall keep records to show: (1) The name of each consumer making a deposit; (2) the premises occupied by the consumer when making the deposit and each successive premises occupied while the deposit is retained by the utility; (3) the amount and date of making the deposit; and (4) a record of each transaction, such as the payment of interest, interest credited, etc., concerning such deposit.

(d) Each utility shall issue to every consumer from whom such deposit is received a certificate of deposit.

(e) Each utility shall provide ways and means whereby a depositor who makes application for the return of his deposit or any balance to which he is entitled, but is unable to procure the original certificate of deposit, may not upon reasonable proof be deprived of his deposit or balance.

CONNECTICUT.

RULE 8. *Deposits, minimum charges, etc.*—(a) To insure payment of periodic bills, any utility may require from any customer or prospective customer a deposit of an amount not to exceed the estimated bill for a period of 30 days in excess of the billing period. Interest thereon, at the rate of 4 per cent per annum, payable annually or upon the return of the deposit, shall be paid by the utility to each customer making such deposit for the time such deposit was held by the utility and the customer was served, unless such period of time be less than three months.

(b) If the reasonableness of any charge, rule, regulation, or practice of any utility with reference to service connections, minimum charges, or meter rentals is challenged, the commission will, upon formal petition and investigation, prescribe the proper charge, rule, regulation, or practice which shall thereafter be followed.

DISTRICT OF COLUMBIA.

ORDER 148. (1) That whenever a deposit is required of a customer by a utility, interest at the rate of 5 per cent be paid thereon during the time that the deposit is retained by the utility.

(2) That this order take effect May 1, 1915, and continue in force until changed or abrogated by further order of the commission.

INDIANA.

RULE 21. *Deposits.*—(a) A utility may require from any consumer or prospective consumer, subject to the approval of the commission, a cash deposit. Interest thereon at the rate of 6 per cent per annum, payable upon the return of the deposit or annually upon demand by the consumer, shall be paid by the utility to each consumer making such deposit, for the time such deposit was held by the utility and the consumer was served.

(b) Each utility having on hand deposits from consumers or hereafter receiving deposits from consumers shall keep records to show: (1) The name of each consumer making a deposit; (2) the premises occupied by the consumer when making the deposit and each successive premises occupied while deposit is retained by the utility; (3) the amount and date of making the deposit; and (4) a record of each transaction, such as payment of interest, interest credited, etc., concerning such deposit.

(c) Each utility shall issue to every consumer from whom a deposit is received a certificate of deposit.

(d) Each utility shall provide reasonable ways and means whereby a depositor who makes application for the return of his deposit or any balance to which he is entitled, but is unable to produce the original certificate of deposit or receipt, may not be deprived of his deposit or balance.

MARYLAND.

2. No utility shall require from any consumer or prospective consumer a deposit intended to pay for all or any part of the cost of extension or installation of service, except under rules and regulations approved by the commission and set down in the published schedules of the utility.

3. (a) A utility may require from any consumer or prospective consumer a cash deposit or other guaranty of an amount not to exceed twice the estimated periodic bill of such consumer. Interest thereon at the rate of 6 per cent per annum, payable upon the return of the deposit or annually upon demand by the consumer, shall be paid by the utility to each consumer making such deposit for the time such deposit was held by the utility and the consumer was served.

(b) Each utility having on hand deposits from consumers, or hereafter receiving deposits from consumers, shall keep records to show: (1) The name of each consumer making a deposit; (2) the premises occupied by the consumer when making the deposit and each successive premises occupied while the deposit is retained by the utility; (3) the amount and date of making the deposit; and (4) a record of each transaction, such as payment of interest, interest credited, etc., concerning such deposit.

(c) Each utility shall issue a certificate of deposit to every consumer from whom a deposit is received.

(d) Each utility shall provide reasonable ways and means whereby a depositor, who makes application for the return of his deposit or any balance to which he is entitled, but is unable to produce the original certificate of deposit or receipt, may not be deprived of his deposit or balance.

MICHIGAN.

41. *Deposits.*—For good reason a utility may require a reasonable cash deposit from any consumer or prospective consumer. Interest thereon at the rate of 4 per cent per annum shall be paid by the utility to the consumer making such deposit for the time such deposit was held by the utility and service given to the consumer. Interest shall be payable upon the return of the deposit, or semiannually upon demand of the consumer.

42. There shall be kept by each utility a record of all deposits received from consumers, showing the name of each consumer, the location of the premises occupied by the consumer at the time of making the deposit and each successive location while the deposit is being retained, the date of making and amount of the deposit, and the date and amounts of interest paid, and any other desirable information.

43. Each utility shall issue to every consumer from whom a deposit is received a certificate of deposit, showing the name of the consumer, location of premises occupied, date of making and amount of deposit, and any other desirable information.

44. Each utility shall provide reasonable ways and means whereby a consumer who makes application for the return of his deposit or any portion of the same to which he may be justly entitled, shall not be deprived of such deposit or portion of same, even though he may be unable to produce the original certificate of deposit.

MONTANA.

RULE 15. *Deposits.*—(a) Each utility may require from any consumer or prospective consumer a deposit intended to guarantee payment of bills. Such deposit shall not exceed the amount of an estimated 45 days' bill of such consumer. Interest shall be paid by the utility upon such deposits at the rate of 6 per cent per annum, payable annually, for the time such deposit was held by the utility, provided such period was not less than six months.

(b) Each utility receiving deposits from consumers shall keep a Consumers Deposit Book showing: (1) The name of each consumer making a deposit; (2) the premises occupied by the consumer; (3) the amount and date the deposit was made; and (4) a record of each transaction concerning the deposit, such as payment of interest and interest credited.

(c) Each utility shall issue to every consumer from whom a deposit is received a nonassignable receipt.

(d) Each utility shall provide reasonable ways and means whereby a depositor who makes application for the return of his deposit or any balance to which he is

entitled, but is unable to produce the original receipt, may not be deprived of his deposit or balance.

MISSOURI.

RULE 12. Each utility may require, at any time, a cash deposit or a personal guaranty of a responsible person, at its option, from any consumer before metered service is furnished; provided that the amount so required to be deposited or guaranteed shall not exceed an estimated bill covering one billing period plus 30 days from such consumer.

Interest at the rate of 6 per cent per annum, payable annually or upon the return of any deposit covering the time of the deposit, shall be paid by the utility to the consumer upon every cash deposit so required; provided said cash deposit remains for a period of at least six months; provided, further, that the rate of interest of such cash deposit shall be only 3 per cent per annum if the utility keeps such cash deposit in a separate and distinct trust fund and deposited as such in some bank or trust company and not used by the utility in the conduct of its business; and provided, further, that this rule shall not be construed so as to conflict with the charter provisions of any city.

Instead of the annual payment of interest on cash deposits as stipulated above, any other interval between payments agreed to in writing by consumer will be satisfactory to the commission.

If the reasonableness of any rule, regulation, or practice of any utility with reference to cash deposits or personal guaranty is challenged, the commission shall, upon complaint and investigation, prescribe the proper rule, regulation, or practice which shall thereafter be followed.

NEW YORK.

Second District.

CASE 1923. *Ordered.* That each and every gas corporation and electrical corporation having on hand deposits of consumers pursuant to section 63 of the transportation corporations law, and each and every such corporation which may hereafter exact deposits from consumers pursuant to said provisions of law, be and the same are and shall hereafter be required:

1. To keep a record of each deposit received, such record to be in accordance with the requirements of the uniform system of accounts prescribed by the commission for gas corporations and electrical corporations as set forth in the account No. 357a, entitled "Consumers' deposits" and reading as follows:

"Credit to this account, as such deposits are made, all cash deposited with the corporation by consumers as security for the payment of (gas-electric) bills. Deposits refunded shall be charged to this account and credited to "cash." Deposits applicable to uncollectible or worthless (gas-electric) bills shall, at the close of the fiscal year (or earlier at the option of the accounting corporation), be credited to the account of the consumer involved and debited to this account."

2. To keep, in addition to the record prescribed in paragraph 1, above, and in such manner as each such corporation may elect, such other and further records as will show with respect to each deposit now on hand or hereafter received (a) the name of the consumer making the deposit, (b) the premises of the consumer at the time the deposit is made and each successive premises occupied by the depositor so long as he remains a consumer or until the deposit with interest be refunded him, (c) the date of the deposit, (d) the amount of the deposit, (e) the interest accrued on the deposit at the end of each calendar year, and (f) a record of each transaction concerning such deposit, and such other information as each such corporation may deem necessary to a complete record of each deposit.

3. To keep, in addition to the records hereinabove prescribed, an index which shall show at all times the name of each and every consumer, alphabetically arranged, from whom a deposit has been exacted, and whose said deposit or a balance thereof is on hand, with appropriate reference on each card to the consumer's ledger account.

4. To allow and pay to every depositor legal interest, to wit, interest at the rate of 6 per cent per annum on the sum deposited for the time his deposit or any balance thereof shall remain with the corporation.

5. To render each depositor, when and as his deposit is applied to unpaid bills, a statement, showing (a) the bill or bills in arrears and unpaid; (b) the amount thereof; (c) the amount of the deposit, together with the accrued interest, applied in payment thereof; and (d) the balance of the bills remaining unpaid, or the balance of the deposit remaining to the depositor's credit, as the case may be.

6. To render such depositor, when and as his deposit may be refunded to him, a statement showing (a) the amount of the deposit; (b) the amount of the accrued interest from the date of the deposit; (c) the interest amounts paid, if any; (d) the amount of the deposit and interest refunded.

7. Each depositor upon ceasing to be a consumer shall have the right to withdraw his deposit and all accrued interest thereon upon surrendering his deposit certificate and payment of all bills for which the deposit is security. Such deposit shall not bear interest from and after the date the depositor ceases to be a consumer. Mere change of residence or of location of service is not to be deemed of itself to be such a cessation.

8. To issue to every consumer from whom, on and after the 1st day of February, 1911, a deposit may be exacted, a certificate of deposit, for which shall be used a good quality of Scotch linen ledger paper of some distinctive color, and there shall be printed upon the face of said certificate in a conspicuous manner the following:

This receipt is not negotiable or transferable.

Six per cent interest is allowed on this deposit and will be paid upon the surrender of this deposit certificate or a suitable voucher in lieu thereof and the payment of all bills for which this deposit is security.

Preserve this receipt to be surrendered when deposit is returned.

9. To keep on hand, for distribution to its customers, printed circulars, over its corporate or business name, such circulars to be entitled "*Terms and conditions upon which consumers' deposits are exacted, held, and may be withdrawn,*" and to contain under said title (a) the provisions in full of section 63 of the transportation corporations law (ch. 219, laws of 1909), (b) the order herein of this commission, (c) and such other terms and conditions under the heading "Rules of the company" as such corporation may elect to prescribe in pursuance of paragraph 7 hereinabove. And every such corporation shall on or before the 1st day of March, 1911, provide each consumer having a deposit with a copy of said circular. And every such corporation shall hereafter, prior to exacting a deposit, present a copy of said circular to the consumer or applicant for service from whom a deposit is demanded.

10. To provide reasonable ways and means, in such manner as every such corporation may elect, whereby a depositor who in good faith makes application for the return of his deposit and is entitled to the return of same, but who is unable to produce the original certificate of deposit or receipt, may not be deprived of his rights; provided he shall make affidavit to the effect that the original certificate has been lost or has disappeared, and bind himself, his executor or administrators, to reimburse the company for any costs or expense incurred by the company on account of the original certificate being presented for payment; and

It is further ordered: That with respect to those certain requirements hereinabove prescribed, the method of complying with which is stated to be elective with each corporation, the commission herein reserves the right to approve or disapprove of the specific methods employed as occasion may demand such action; and

It is further ordered: That this order shall take effect the 1st day of February, 1911, and shall continue in force until changed or abrogated by this commission.

NORTH DAKOTA.

RULE 21. Deposits.—(a) A utility shall require from all consumers or prospective consumers, subject to the approval of the commission, a cash deposit. Interest thereon at the rate of 6 per cent per annum, payable upon the return of the deposit, or annually upon demand by the consumer, shall be paid by the utility to each consumer making such deposit, for the time such deposit was held by the utility and the consumer was served.

(b) Each utility having on hand deposits from consumers or hereafter receiving deposits from consumers shall keep records to show: (1) The name of each consumer making a deposit; (2) the premises occupied by the consumer when making the deposit and each successive premise occupied while deposit is retained by the utility; (3) the amount and date of making the deposit; (4) payment of interest shall be paid upon demand.

(c) Each utility shall issue to every consumer from whom a deposit is received a certificate of deposit that shall receive the approval of the commission under rule 32-(b).

(d) Each utility shall provide reasonable ways and means whereby a depositor makes application for the return of his deposit or any balance to which he is entitled, but is unable to produce the original certificate of deposit may not be deprived of his deposit or balance.

OKLAHOMA.

RULE 37. Deposits from consumers to guarantee payment of bills.—(a) Each utility may require from any consumer or prospective consumer a deposit intended to guarantee payment of current bills. Such required deposit shall not exceed the amount of an estimated 45 days' average bill of such consumer: *Provided, however,* That a minimum deposit of \$5 may be required. Interest thereon at the rate of 5 per cent per annum, shall be paid to said consumer annually, and when service is discontinued, and the consumer makes application for the return of his deposit, the utility shall pay 5 per cent interest on said deposit for the period since the last annual interest payment that such deposit is held by the utility, and the consumer is served, provided such period is not less than six months.

(b) Each utility having on hand deposits from consumers, or hereafter receiving deposits from them, shall keep records to show: (1) The name of each consumer making such deposits; (2) the premises occupied by the consumer making such deposits; (3) the amount and date of making the deposit; and (4) a record of each transaction concerning such deposit, such as payment of interest, interest credited, etc.

(c) Each utility shall issue to every consumer from whom a deposit is received a nonassignable receipt.

(d) Each utility shall provide reasonable ways and means whereby a depositor who makes application for the return of his deposit, or any balance to which he is entitled, but is unable to produce the original certificate of deposit or receipt, may not be deprived of his deposit or balance.

OREGON.

RULE 8. Deposits.—(a) Any utility may require from any customer or prospective customer a deposit on account of current bills, (1) in the case of customers whose bills are payable in advance, not to exceed an estimated 30 days' bill; (2) in the case of customers whose bills are not payable in advance, not to exceed the estimated 60

days, bill of such customer. Interest thereon, at the rate of 6 per cent per annum, payable annually or upon the return of the deposit, shall be paid by the utility to each customer making such deposit, for the time such deposit was held by the utility and the customer was served, unless such period of time be less than three months.

(b) No utility may require from any customer or prospective customer a deposit to pay any part of the cost of installation, except under rules and regulations approved by the commission and set out in the published schedules of the utility.

SOUTH CAROLINA.

RULE 22. *Deposits from consumers and guarantee payment of bills.*—(a) Each utility may require from any consumer, or prospective consumer, a cash deposit or other acceptable security intended to guarantee payment of current bills. Such required deposit or other security shall not exceed the amount of an estimated 60 days' bill of such consumer. Interest shall be paid by the utility upon cash deposits at the rate of 6 per cent per annum, payable upon the return of the deposit, for the time such deposit was held by the utility, and the consumer was served by the utility; provided such period was not less than six months. If security other than cash is tendered by consumer and such security is not acceptable to the utility, then the consumer may submit to the commission security offered and the action of the commission shall be binding on both parties.

(b) Each utility having on hand cash deposits from consumers or hereafter receiving deposits from them, shall keep records to show: (1) the name of each consumer making such deposit; (2) the premises occupied by the consumer when the deposit was made; (3) the amount and date of making the deposit; (4) a record of each transaction concerning such deposit, such as payment of interest, interest credited, etc.

(c) Each utility shall issue to every consumer from whom a cash deposit is received, a nonassignable receipt.

(d) Each utility shall provide reasonable ways and means whereby a depositor who makes application for the return of his deposit or any balance to which he is entitled, but is unable to produce the original certificate of deposit or receipt, may not be deprived of his deposit or balance.

WASHINGTON.

No. 9. Each company supplying gas, electric current, or water may require a deposit or advance payment or other security from the consumer before service is supplied, provided that the amount so required shall not exceed the estimated monthly bill from each consumer. Interest at the rate of 8 per cent per annum payable annually (or upon returning of any deposit covering the time of the deposit) shall be paid by every company to its consumers upon every deposit so required, provided said deposit remains for a period of at least six months, and provided further, that interest shall cease when the consumption of the product used ceases. If the reasonableness of any rule, regulation, or practice of any company with reference to deposits and advance payments is challenged, the commission shall upon investigation, prescribe the proper rule, regulation, or practice which shall thereafter be followed.

WEST VIRGINIA.

RULE 32. *Deposits.*—Any utility may require from any consumer or applicant a minimum cash deposit of \$2.50, or other guaranty of an amount not to exceed the estimated 60-day bill of the consumer, where bills are rendered monthly, or for an amount not to exceed the estimated four months' bill of such consumer where bills are rendered quarterly. Interest on all cash deposits at the rate of 6 per cent per annum, payable annually or upon the return of the deposit, shall be paid by the utility to every consumer making such deposit, for the time such deposit was held by the utility. But one deposit shall be required of a consumer for each service.

On or before the 10th day of January of every year the utility shall publish in some newspaper of general circulation in the county in which it operates and in which such deposits are made a list, as of the 31st day of December immediately preceding, showing the deposits it is holding where the person, firm, or corporation making such deposit has ceased to be a consumer, the amount of such deposit, together with the interest due thereon, and the name of the maker of same. No interest shall be paid on any deposit so published after date of such publication.

DISCONTINUING SERVICE.

ARIZONA.

RULE No. 22. Every public-service utility supplying electricity or gas shall use diligent methods in the collection of its accounts with the purpose of largely eliminating the loss of revenue through bad debts, and to reduce the working capital necessary in the operation of the utility. With this in view, any public-service utility may discontinue the service of a consumer who is delinquent in his account for gas or electricity in excess of 20 days. All amounts due the utility for gas service or electric service and a charge not to exceed \$2 per meter for extraordinary expenses may be collected from the consumer by the utility before the service is again rendered.

CALIFORNIA.

RULE 5. A water, gas, electric, or telephone utility may not, for failure to make a deposit, discontinue a metered service for which bills are normally made out monthly until the expiration of at least 15 calendar days after written notice of intention so to do; nor where the bills are normally made out weekly until the expiration of at least 4 calendar days after written notice of intention so to do; nor where the bills are normally made out fortnightly until the expiration of at least 7 calendar days after written notice of intention so to do; nor where the bills are normally made out for periods in excess of one month, until the expiration of at least 30 calendar days after written notice of intention so to do.

RULE 6. A water, gas, electric, or telephone utility may not discontinue service by reason of nonpayment of bills for metered or measured service theretofore delivered, in cases in which there is a dispute as to the amount of the bill. In case of such dispute, the consumer shall deposit with the Railroad Commission the amount claimed by the utility to be due, whereupon the Railroad Commission will investigate the facts and communicate its findings to the parties. Failure on the part of the consumer to make such deposit within 15 days after demand by the utility that such deposit be made, shall warrant the utility in discontinuing the service.

RULE 9. A water, gas, electric, or telephone utility may not for failure to pay for service, discontinue an unmetered service for which bills are normally made out monthly until the expiration of at least 15 calendar days after written notice of intention so to do; nor where the bills are normally made out weekly until the expiration of at least 4 calendar days after written notice of intention so to do; nor where the bills are normally made out fortnightly until the expiration of at least 7 calendar days after written notice of intention so to do; nor where the bills are normally made out for periods in excess of one month, until the expiration of at least 30 calendar days after written notice of intention so to do.

COLORADO.

RULE 13. Discontinuance of service.—No utility shall discontinue the service of any consumer for violation of any rule of such utility except upon written notice of at least 48 hours, advising the consumer in what particular such rule has been violated for which service will be discontinued. This rule may be waived where a by-pass

is discovered on a consumer's service meter, or in the event of the discovery of dangerous leakage or short circuit on a consumer's premises, or in the case of a consumer utilizing the service in such a manner as to make it dangerous for occupants of the premises, thus making an immediate discontinuance of service to the premises imperative.

MISSOURI.

RULE 11. No utility shall discontinue the service of any consumer for violation of any rule of such utility except on written notice of at least 48 hours, advising the consumer in what particular such rule has been violated for which service will be discontinued. It is recommended that such notice be served in the following manner for the reasons set forth:

First.—By inclosing in a registered letter addressed to the consumer a copy of the notice to be served; and the return registry receipt of any such registered letter shall be prima facie evidence of the service of any such notice; and the utility shall preserve a copy of said notice to which shall be attached such return registry receipt, which at all times and in any proceeding resulting from or growing out of said notice, or anything complained of, and contained or set out in said notice, shall be prima facie evidence of service of any such notice.

Second.—A delivery of a copy of any such notice to the consumer or by leaving a copy at his usual place of abode with some member of his family over 15 years of age shall be deemed and, for the purposes of these rules, is hereby made sufficient service of any notice required to be served under this rule. Any such notice may be served by any agent, employee, or servant of the utility and the person serving the same shall make return showing the kind of service had, and the return shall be preserved the same as above set out in case of service by registered letter.

This rule may be waived where a by-pass is discovered on a consumer's service meter or in the event of discovery of a dangerous leakage or short circuit on a consumer's premises, or in case of a consumer utilizing the service in such a manner as to make it dangerous for occupants of the premises, thus making the immediate discontinuance of service to the premises imperative. In the event of discontinuance of service for any of these reasons, the consumer should be notified of such discontinuance immediately with a statement concerning reasons for discontinuance.

MONTANA.

RULE 17. *Discontinuance of service for violation of rules, or nonpayment of bill.*—(a) No utility shall discontinue service to any consumer for violation of the rules or regulations, or for nonpayment of bills, without first having diligently tried to induce the consumer to comply with its rules and regulations or to pay his bills. Service shall actually be discontinued only after at least 24 hours written notice of such intention shall have been given the consumer by the utility: *Provided, however,* That where fraudulent use of current is detected, or where a dangerous condition is found to exist on a consumer's premises, the service may be discontinued without advance notice.

(b) Whenever service is discontinued for violation of rules, regulations, nonpayment of bill, or fraudulent use of current, service shall not be resumed until a settlement has been made between the consumer and the utility. In addition to such settlement, the utility may charge the consumer \$1 for the cost of making reconnection.

OKLAHOMA.

RULE 39. *Discontinuance of service for violation of rules, or nonpayment of bills.*—(a) No utility shall discontinue the service of any consumer for violation of its rules or regulations, or for nonpayment of bills, due under their present or any previous

contract, without first giving said consumer a written notice of his failure to comply with the rules and regulations, or that his bill is delinquent after a certain date. Such a notice having been served with no result, the utility may then serve a written notice on the consumer that, after 48 hours from the date and hour said notice is mailed, the service of said consumer will be discontinued if rules and regulations are not complied with and delinquent bills paid before such time expires.

(b) Showing made by the utility of a duplicate copy of said written notices to the consumer shall be taken as evidence that the notices have been served on the consumer.

(c) Where fraudulent use of electricity is detected, or where the utility's measuring instruments or equipment have been tampered with, or where a dangerous condition is found to exist on the consumer's premises, the service may be shut off without notice in advance.

(d) The utility shall (subject to provisions of rule 39 (e)) reconnect the consumer within 24 hours after he has paid all delinquent bills, remedied any dangerous condition that may have existed on his premises, and complied with the reasonable rules and regulations of the company, but where service has been discontinued for fraudulent use of energy, or where the utility's measuring instruments or equipment have been tampered with, the utility may refuse to reconnect said consumer until ordered to do so by the commission, pending hearing or after hearing by said commission.

(e) Whenever electric service to any consumer is discontinued for the violation of rules or regulations non-payment of bills, or fraudulent use of energy, the utility may make a reasonable charge for the cost to it of restoring the service, such charge in no event to exceed the sum of \$1.

SOUTH CAROLINA.

RULE 23. *Discontinuance of service for violation of rules or nonpayment of bills.*—(a) No utility shall discontinue the service to any consumer for violation of its rules or regulations, or for nonpayment of bills without having first diligently tried to induce the consumer to comply with its rules and regulations or to pay his bills.

Service shall actually be discontinued only after at least 24 hours' notice of such intention shall have been given to the consumer by the utility: *Provided, however,* That where fraudulent use of current is detected, or where a dangerous condition is found to exist on the consumer's premises, the service may be shut off without notice in advance.

(b) Whenever the service is turned off for violation of rules or regulations, non-payment of bill, or fraudulent use of current, the utility may make a reasonable charge for the cost of renewing it.

WEST VIRGINIA.

RULE 34. *Consumer's discontinuance of service.*—Any consumer desiring service discontinued, shall give five days' written notice to the utility thereof.

DISCOUNTS FOR PROMPT PAYMENT.

MICHIGAN.

45. *Application of discount.*—It is recommended that rates shall be so made as to allow discounts for prompt payment of bills, and that the bills rendered to the consumers shall show both the gross charge and the net charge.

46. Discounts allowed for prompt payment shall be forfeited by the consumer if the bill is not paid by the discount date. Failure to receive a bill properly rendered by the utility will not extend the discount period. If the discount date falls on a Sunday or holiday the bill shall be due on the next business day. Customers mailing

remittances before midnight of the last day of the discount period shall receive the benefit of the discount, the time of mailing to be taken as the time of receipt at the post office.

47. It is recommended that bills be delivered by the utility to the consumer's premises, and that delivery be made at least seven days prior to the discount date. It is further recommended that the utility make arrangement for the payment of bills by consumers at the local banks, and no extra charge shall be made by the utility for such arrangements.

EXTENSION OF LINES.

CALIFORNIA.

III. EXTENSIONS.

RULE 15. A water, gas, electric, or telephone utility which operates under a general franchise authorizing the occupancy of all the streets of a municipality shall make, at its own expense, such street extensions as may be necessary to serve applicants; provided, that in any case in which the construction of an extension at the utility's sole cost will in its opinion work an undue hardship upon the utility or its existing consumers, the matter may be submitted to the commission as provided by section 36 of the public utilities act, unless satisfactorily adjusted by an informal application to the commission.

RULE 16. A water, gas, electric, or telephone utility shall make such reasonable extensions in unincorporated territory at its own expense as it can agree upon with the applicant for service; provided, that in any case in which the construction of an extension at the utility's sole expense will in its opinion work an undue hardship upon the utility or its existing consumers, the matter may be submitted to the commission as provided by section 36 of the public utilities act, unless satisfactorily adjusted by an informal application to the commission.

RULE 17. In cases in which applicants make payments to secure the construction of extensions by water, gas, electric, or telephone utilities, such payments shall generally be considered as loans to the utilities, to be repaid, as soon as conditions warrant, under reasonable nondiscriminatory rules and regulations.

COLORADO.

(b) Service connections to the consumer's premises in the case of electric utilities, and to the consumer's property line in the case of gas and water utilities, shall be installed and maintained at the expense of the utility. This rule shall not apply when unusual conditions are encountered, or to long service connections. When such special cases arise, the commission will, if necessary, prescribe the proper charge.

(c) Any utility may require through its rules and regulations that prospective consumers advance the full cost of service connections, the amount so advanced to bear no interest, and to be applied on the consumer's bills until such time as the amount of service furnished under the prescribed schedule or rates shall equal the amount so deposited. Such deposits shall not cover the cost of meters, since these may be recovered by the utility upon the discontinuance of service by the consumer. Any utility may likewise require such deposits from consumers whose service connections are replaced for any cause. It is further provided that no consumer's deposit or advance payment for service shall be required from consumers making deposits for service connections, until such time as the amount so deposited for service connections have been exhausted.

(d) No utility shall require from any consumer or prospective consumer a deposit intended to pay for all or any part of the cost of extension of mains or the installation of service connections, except under rules and regulations set down in the public schedules of the utility on file with this commission.

DISTRICT OF COLUMBIA.

3. That upon application to serve premises with electricity, the Potomac Electric Power Co. shall extend its mains, without cost to the applicants, a distance of 35 feet in length per customer for underground construction and 250 feet in length per customer for overhead construction, provided that this length of extension is sufficient to reach the premises. In cases when the lengths above mentioned are not sufficient to reach the premises, the Potomac Electric Power Co. shall make the entire extension, provided the applicant or applicants deposit with the company \$3.25 per lineal foot for underground construction and 40 cents per foot for overhead construction for the length of the extension in excess of the free amount of extension per customer. This deposit will bear no interest but will be returned by the company to the depositor at the rate of \$114 in case of underground construction, and \$100 in case of overhead construction for each additional customer served from the extension for which said deposit has been made, or from any further extension from and connected to the extension covered by the deposit, until the original principal amount of the deposit is returned, but in no extent will the amount refunded exceed the amount of the original deposit.

The free allowance stated in the first paragraph of this rider do not apply in cases where, to serve the applicant's premises, the company must extend its mains from extension on which there remain unrefunded deposits or portion of deposits. In such cases the allowance by the company of 35 feet per customer, in case of underground construction, or 250 feet per customer in case of overhead construction is applied at the respective rates per foot of \$3.25 and 40 cents, aforementioned to refund of the existing deposit or deposits in the chronological order in which such deposits are made. Where refunds are to be made, in accordance with the above, to two or more parties having deposits on the same extension and made at the same time, the amounts of the aggregate refunds are at the rates hereinbefore stated, but the amount of each individual refund is in proportion to the amount each party has on deposit. After the deposit or deposits on an extension have been entirely refunded no further refund or allowance will be made for further connection to, or extension from such an extension.

INDIANA.

RULE 31. Extension of lines in municipalities and in immediate vicinity of municipalities.—(a) *Jurisdiction.*—The Indiana Service Commission Act of 1913 contains the following provisions:

SEC. 110. Every municipal council shall have power, * * * to require of any public utility by ordinance or otherwise such additions and extensions to its physical plant within said municipality as shall be reasonable and necessary in the interest of the public, and to designate the location and nature of all such additions and extensions, the time within which they must be completed and all conditions under which they must be constructed subject to review by the commission * * *.

In the matter of extensions of facilities for utility service in municipalities the commission exercises only appellate jurisdiction. The commission believes that under ordinary conditions the following provisions are reasonable and in matters coming before it the commission will be guided by them.

(b) *Free extensions.*—Each utility should, upon written request for service by a prospective consumer or a group of prospective consumers located in the same neighborhood, make free of charge a line extension necessary to give service and furnish free service connection when the estimated total revenue for a period of three years, from the prospective consumer or consumers is approximately equal to the entire direct cost of the extension: *Provided*, That the prospects are that the patronage or demand will be of such permanency as to warrant the capital expenditure involved.

(c) *Extension above free limit.*—If the line extension required in order to furnish service at any point within the corporate limits of a municipality, or for any adjacent

suburb of a municipality, is greater than the free extension specified above, such an extension shall be made under the following conditions: The utility may require a deposit of the cost of the extension above the free limit and should, in such case, refund an amount equal to the cost of the free line extension per consumer for each additional consumer whose service shall be connected within a period of six years from the making of such an extension, but at no time shall the aggregate rebates made exceed the original deposit. If the extension is of such length, and the prospective business which may be developed by it is so meager as to make it doubtful whether the business from the extension would ever pay a fair return on the investment involved in such extension or in the case of real estate development enterprises with slight or no immediate demand for service, or in the case of an industrial installation requiring extensive equipment with slight or irregular service, the facts shall be reported to the municipality and to the commission for investigation and determination as to the reasonableness of such extension or installation and the conditions under which it shall be made.

This rule shall not be construed as prohibiting any utility from making free extensions of lengths greater than above specified, or from providing a method of return of deposits for extensions more favorable to consumers, so long as no discrimination is practiced between consumers whose service requirements are similar.

(d) *Contract for service.*—Utilities should not be required to make line extensions as described in this rule unless those to be served by such extensions shall contract to use the service for at least three years. The utility may require of the prospective consumer on a proposed extension a satisfactory and reasonable guarantee that he will fulfill all the obligations made by him to the utility.

RULE 32. Extension of lines for rural service.—(a) *Definition.*—A rural consumer is one whose premises are without the corporate limits of a municipality and one requiring an investment per consumer's unit demand greater than is ordinarily required for consumers within municipalities.

(b) *Cost of service.*—Rural consumers may have electric service, provided they will compensate the utility for the fixed and operating costs of the service.

(c) *Rates.*—Rates must not be discriminatory and because greater investment is required per rural consumer's unit demand and greater line loss is suffered in rural distribution than with municipal consumers, the rates should be higher for rural service than for service in the utility municipal area. All consumers must bear their fair share of the utility's expenses some of which may be enumerated as follows:

Interest on investment.

Depreciation.

Taxes.

Insurance.

General office and officers' expenses.

Operating labor and supplies.

Maintenance.

Coal.

Meter reading, accounting and collecting, etc.

(d) *Form of Rate.*—The rate shall consist of two parts (1) a "minimum bill" to partially cover the fixed charges, (2) an "energy charge" to cover the operating costs of generation, transmitting, and distributing the electric current.

(e) *New consumer.*—A new consumer proposing to take service from an extension paid for by a group of consumers shall share in the cost of the extension.

(f) *Guarantee.*—The utility may require of the prospective consumer a satisfactory guarantee that he will fulfill all the obligations made by him to the utility.

(g) *Safety.*—Safety in construction and maintenance is essential. Divided ownership and responsibility are not good public policy and the construction of electric lines by inexperienced persons or companies is discouraged.

(h) *Acquisition of lines.*—To the end that safety and uniformity may be obtained in the rehabilitation and maintenance of electric lines the utility may acquire lines owned and constructed by others.

ILLINOIS.

RULE 22. Extension of lines.—(a) *Free extensions.*—If an extension of a utility's distribution system should be necessary in order to serve an applicant or group of applicants whose premises are located in a municipality within which the utility is authorized to operate, the utility, upon written request for service by such applicants, shall furnish and install necessary service wires of reasonable length and shall make the necessary extension to give service provided that such line extension does not require more than twice as many poles, spaced according to the utility's standard practice, as there are individual applicants. Where part of the extension is made on existing poles, the utility shall make at its own expense an extension equivalent in cost to that of an average two-pole extension of new construction in the particular community. This provision of the rule will be considered as satisfied if the utility makes at its own expense on existing poles an extension of four spans of secondary construction.

Where service within a municipality can be furnished by the installation of a transformer on a primary circuit in accordance with the usual practice, the utility shall furnish service without charge provided the expense will not be greater than an average cost of free extension in that community.

(b) *Extensions above free limit.*—If the line extension required in order to furnish service is greater than the free extension specified above, such an extension shall be made under the following conditions: The utility may require a deposit of the cost of the extension above the free limit and shall, in such a case, refund an amount equal to the cost of the free extension for each additional consumer whose service shall be taken from the extension or from any extension thereof within a period of 10 years from the making of such an extension, but at no time shall the rebate made exceed the original deposit.

(c) If it appears that the consumption is sufficient to justify a longer free extension than that specified in 22 (a) the consumer may secure said extension under the following conditions: The consumer shall guarantee to the utility a definite revenue for the first year during which the service is to be furnished. The utility shall then install at its own expense an amount of construction the cost of which, including items of material and labor only, is equal to three times this annual guarantee and may require a deposit to cover the excess of this cost over three times the guaranteed annual revenue.

At the end of the first year the utility shall refund to this consumer three times the excess of the actual revenue from this consumer over the guaranteed revenue. The utility shall refund also to this consumer an amount equal to three times the first annual revenue from each additional consumer who is furnished service from this extension or from any extension thereto within 10 years after its construction. In no case shall the refund to any consumer exceed the original deposit.

(d) The distance of the applicant from the nearest existing secondary circuit shall be considered in determining whether he is entitled to a free extension and the cost of extending the nearest existing secondary circuit shall be used as the basis in determining the amount of deposit necessary in case the extension is above the free limit. The cost of transformers and primary construction shall not be included nor shall the cost include the expense of making changes in the existing construction.

(e) A utility shall not be obliged to make the extension as required by this rule unless the applicant shall furnish a suitable guarantee that he will use the service for at least one year, or unless the owner of the property served by such extension or some other responsible party shall guarantee that the service will be used for that length of time.

(f) If the extension is of such length and the prospective business which may be developed by it is so meager as to make it doubtful whether the business from the extension would ever pay a fair return on the investment the fact shall be reported to the commission for investigation and determination as to the reasonableness of such extension.

General Order 59 (as amended).

CLASSIFICATION OF RURAL CONSUMERS.

Rural consumer defined.—For the purposes of this order, a rural consumer is defined as any consumer, except industrial light and power consumers, located outside the corporate limits of an incorporated municipality.

Rural consumers classified.—For the purposes of this order, rural consumers are divided into three classes:

Class I.—Those prospective rural consumers who shall organize a corporation for the purpose of constructing the lines necessary to furnish the service and who propose to render such service to all applicants along the routes of the said lines.

Class II.—Those prospective rural consumers who have formed a corporation, organization, or association of a strictly mutual character for the purpose of operating without profit for the securing of electric service to stockholders alone.

Class III.—Those rural consumers who contemplate receiving electric service as individuals; that is, those consumers who expect the electric utility furnishing the service to furnish a meter for each consumer and to read these meters and collect each consumer's bill separately.

CLASS I. THOSE CONSUMERS WHO HAVE FORMED A CORPORATION FOR RENDERING SERVICE.

1. *Certificate of convenience and necessity.*—Those consumers who have formed a corporation as given under Class I, and who expect to render service to all applicants along the routes of the lines built by them, are public utilities and as such shall secure from the commission, in the manner provided by law, a certificate of convenience and necessity authorizing the construction and operation of the necessary lines before any of the said construction work is undertaken. All construction work undertaken by corporations organized under this rule shall be done entirely in compliance with the commission's general order 30 establishing standards for overhead electrical construction. Any electric public utility who shall be requested to furnish wholesale electric service for such a corporation shall refuse to connect its circuits with the circuits of such corporation until these requirements of the rules have been complied with.

2. *Rates to other utilities.*—Electric public utility companies who shall furnish service to such rural corporations shall sell energy to them only at rates filed with and authorized by the commission for the type of service to be rendered, provided that all terms and conditions precedent to the securing of such rates have been fulfilled by the rural corporation.

3. *Rates to be filed.*—Such a corporation shall file with the commission in compliance with the law a complete schedule of its rates and charges covering all classes of service to be rendered by it.

CLASS II. THOSE CONSUMERS WHO HAVE FORMED A MUTUAL ORGANIZATION.

1. *Standard construction required.*—If the prospective rural consumers have formed a corporation, organization, or association of a mutual character, for the purpose of operating without profit as set forth under Class II above, any electric public utility which may agree to furnish service at wholesale to such mutual organization shall, before connecting its circuits with the circuits of such mutual organization, make certain that the character of the construction installed by such mutual organization

will meet all requirements of the commission's general order 30 establishing standards for overhead electrical construction.

2. *Rates to mutual organization.*—The rates at which such mutual organization shall purchase energy must be only such duly authorized rates as the electric utility furnishing the service may have on file with the commission for the class of service to be rendered.

3. *Agreements for construction and operation of property.*—The construction, maintenance, and operation of the property of a mutual organization may be made the subject of an agreement between the electric utility company and the organization, which agreement shall be filed with the commission by the utility furnishing the service in its regular rate file.

CLASS III. THOSE CONSUMERS RECEIVING SERVICE AS INDIVIDUALS.

1. *Ownership and maintenance of lines.*—In the case of consumers receiving service as individuals, the arrangements as to the construction and ownership of the necessary lines, transformers, lightning arresters, and other equipment, must be such that the title to the said lines and equipment, when completed, will rest in the electric public utility and that the electric public utility shall be responsible for their maintenance, operation, and replacement.

2. *Additional consumers on existing lines.*—It must be agreed between the utility furnishing the service and the consumers along any proposed distribution line that additional consumers along the route of the said line or extensions thereof shall receive service if applying for the same upon a nondiscriminatory basis. If unable to agree, the parties may appeal to the commission, which will render a decision upon the merits of the case.

3. *Expense of construction of lines.*—The proposed distribution circuits for the serving of the consumers covered by this class may be constructed at the expense of either the electric utility or the prospective consumers, as the rules filed by the electric utility in compliance with this order shall provide.

4. *Lines constructed at the expense of the utility.*—If the distribution lines required are to be constructed at the expense of the utility furnishing the service, such utility shall first secure in the manner provided by law a certificate of convenience and necessity covering the construction and operation of the necessary lines, and the said construction must comply with the standards set forth in general order 30, which provides standards for overhead electrical construction.

5. *Lines constructed at the expense of the consumer.*—In case the construction is to be at the expense of the consumers, the actual construction work may be done either by the prospective consumers themselves or by the utility at the expense of the consumers, as the consumers may elect. In any case the actual construction work must be done in accordance with the rules laid down in the commission's general order 30, which provide standards for overhead electrical construction.

6. *Combining of service.*—In case the individual consumer has on his own or adjoining premises owned by him a number of buildings, such as employee's houses, barns, etc., to which electric service is desired and the consumer desires to receive this service over one meter, pay one service charge, and assume the responsibility for payment of the entire bill, the utility shall so furnish the service, provided the consumer is willing, at his own expense, to provide all construction necessary to connect the various buildings and to bring the common service to the building most conveniently located to the company's lines where the common meter may be placed.

7. *Construction work done by consumer.*—In case the construction is to be done by the prospective consumers, the utility which is to furnish the service, before assuming ownership of the lines constructed as set forth in rule 1, shall secure, in the manner provided by law, a certificate of convenience and necessity authorizing the utility to take over and operate the said lines.

8. *Certificate of convenience and necessity.*—Before the certificate of convenience and necessity referred to in the foregoing rules is issued, the commission will require the filing of a plat showing the exact route of the lines and will require evidence that possible inductive interference with the lines of other wire using utilities has been considered and properly provided against, as set forth in Section II, rules 204, 205, and 206, of general order 30, as amended and adopted March 16, 1920. It is recommended that prospective consumers, who expect to do their own construction work, should make all the arrangements necessary and secure a written contract for the service (if required) from the public utility which is to furnish the service before any construction work is done. Upon the signing of the contract for service between prospective consumers and a utility, the utility must immediately apply to the commission for the certificate of convenience and necessity provided for in these rules.

9. *Rates and rules for service to be filed.*—Before any electric public utility shall construct or extend distribution circuits into rural territory or connect its circuits to any distribution circuit for the purpose of serving individual consumers, such utility shall first file with the commission as part of its rate schedule for each community from which such service is furnished (or one schedule covering rural service to its entire territory in case the same rates and rules are to apply to the entire territory), and in accordance with the provisions of general order 28, a statement of the terms and conditions under which such service will be rendered and the rates which shall apply to the service after these terms and conditions have been fulfilled. This statement shall contain the following items:

- (a) A description of the general type or types of lines to be constructed.
- (b) A statement of the proportion of the cost of construction of said lines and other equipment which the utility will bear.
- (c) An explanation of the basis upon which additional consumers may be served from existing lines or extensions thereof.

10. *Rates to individual rural consumers.*—For the purpose of rendering bills for electric service furnished to individual consumers served under the provisions of the third section of this order, the utility shall file with the commission a statement of the fundamental charges as hereinafter contemplated upon which the type of rates shall be based. All rates for service to individual rural consumers shall consist of a service charge in addition to the regular urban rates provided for hereinafter.

11. *Service charge.*—The amount of the service charge shall represent the excess cost to the utility of furnishing the rural consumer with the class of service which he demands over the cost to the utility of furnishing the same service to a like consumer in urban territory, including such items as are ordinarily represented by the minimum bill.

12. *Uniformity of service charge.*—The service charge to each consumer on the same line shall be identical, except such portion of the service charge as may vary between individual consumers on account of the difference in size and cost of their transformer and meter installation. The service charge to consumers on different lines may vary as the expense to the utility of furnishing service over the different lines shall vary.

13. *Rate for energy used.*—The rate for the energy used by individual consumers shall be the same rate, including demand charges, if any, as charged to consumers demanding the same class of service in the municipality from which the service is furnished. The items ordinarily covered by the minimum bill in urban service are included in the service charge provided for in rule 11.

14. *Municipality from which service is furnished.*—In the case of lines extended from a municipality where service is furnished, into rural districts solely for the purpose of furnishing energy to rural consumers along the routes of said lines, the service shall be deemed to be furnished from the municipality from which said lines are

extended. In case distribution lines are constructed from a transmission line extending between municipalities, for the sole purpose of furnishing electric service to rural consumers located along the route of such distribution line, the service shall be deemed to be furnished from the municipality located nearest to the junction of the main transmission line and the rural extension, as measured along the main transmission line. In case individual rural consumers are connected directly to a transmission line between municipalities the service shall be deemed to be furnished from the municipality nearest the point at which the connection is made to the main transmission line for the consumer's service, as measured along the main transmission line.

15. *Meter readings.*—The commission recommends that the rules provide for the reading of meters at not less than three months' intervals, but that provision be made for billing the service charge in monthly installments. This recommendation, however, shall not prevent utilities from securing readings of the meters of rural consumers at less intervals than three months if they so desire, or if special conditions surrounding the service make the same necessary.

16. *Type of equipment on rural lines.*—It is strongly recommended that all utilities furnishing service to rural consumers should adopt as standard equipment for the furnishing of this service the most modern devices of this nature which can be secured. Devices should be used which have as the controlling factor of their design the possibility of the consumer taking care of ordinary interruptions of service, i. e., such devices as are constructed to enable the consumer to safely remove and replace burned out fuses and other small operations of this nature. It is also recommended that the utilities should devote some time to instructing their rural consumers in the operations of removing and replacing fuses and locating all ordinary sources of trouble and interruption, to the end that the service furnished these consumers may be of the most continuous and satisfactory character and rendered with the least possible expense to the consumer for maintenance charges.

Saving clause.—The adoption of these rules shall in no way prevent the commission from considering any case of a demand for service which may be brought to its attention upon its own merits, nor shall it in any way preclude the commission from altering, modifying, or amending these rules from time to time as may be necessary or advisable. Adopted by the commission December 8, 1920. Effective January 1, 1921.

MICHIGAN.

59. *Application.*—The following recommendations shall not be construed as prohibiting any utility from making extensions under conditions more favorable than the principles proposed allow, provided no discrimination be made as between consumers whose service requirements are similar.

60. *When required.*—Under ordinary circumstances, a utility should not be expected to make a line extension according to the following principles unless the consumers to be served shall contract to use the service for a minimum of two years.

61. *Free extensions.*—When a formal request for service is made of a utility by a prospective consumer or a number of prospective consumers grouped together in the same vicinity, it is recommended that the utility make free of charge such line extensions as may be necessary for giving service, and furnish free service connections; provided the estimated gross revenue for a period of two years from such prospective consumers is equal to the direct cost of making the extension, and provided that the prospective demand shall be of such permanency and the probable future growth of the demand shall be such as will justify the capital expenditure required.

62. *Restricted extensions.*—If the direct cost of making a line extension is greater than the estimated gross revenue for a period of two years then it is recommended that the following principle be made to apply: The utility may require the prospec-

tive consumers to furnish a subsidy equal the difference between the direct cost of the extension and the estimated gross revenue for a period of two years, such subsidy to be refunded to the original prospective consumers in annual installments equal to 10 per cent of the excess of the annual gross revenue after the first two years above one and one-half times the average estimated annual gross revenue for the first two years.

MONTANA.

RULE 32. Extensions.—(a) Each utility shall, upon written request for service by a prospective consumer or a group of prospective consumers, located in the same neighborhood, make free of charge a line extension of 300 feet for each prospective service; that is to say, if there are three prospective consumers, the extension shall be 900 feet. The service from the pole to the consumer's building will be considered as a portion of the 300 feet free limit.

(b) Extensions for power will be made on the basis of 100 feet for each horsepower connected.

(c) Utilities will not be required to make power extensions as described in this rule unless those to be served by such extensions shall agree to use the service for at least three years. The utility may require of each prospective consumer on a proposed extension a satisfactory and reasonable guarantee that he will fulfill all of the obligations made by him to the utility.

(d) If the line extension required in order to furnish service at any point within the corporate limits of a municipality or for any adjacent suburb of a municipality is greater than the free extension specified above, such an extension shall be made under the following conditions: The utility may require a deposit from the prospective consumer or consumers equal to the cost of the extension above the free limit, and shall refund to each consumer monthly thereafter 25 per cent of his net service bill until the full amount has been repaid. The utility shall further refund pro rata an amount equal to the cost of the free line extension for each additional consumer whose service shall be connected within a period of six years from the making of an extension under this rule, but at no time shall the aggregate rebates exceed the original deposit.

(e) If any extension petitioned for is of such length, and the prospective business which may be developed by it is so meager as to make it doubtful whether the business would ever pay a fair return on the investment involved in such extension or in the case of real estate development enterprises with slight or no immediate demand for service, or in the case of an industrial installation requiring extensive equipment with slight or irregular service, the facts shall be submitted to the commission for investigation and determination as to the reasonableness of such extension or installation and the conditions under which it shall be made.

(f) Safety in construction and maintenance is essential. Divided interest and responsibility are not good public policy and the construction of electric lines by inexperienced persons is discouraged. To the end that safety and uniformity may be obtained, all extensions will be built according to the specifications of the utility conforming to its standard practice on similar lines. The utility will be responsible for maintenance, and will have complete ownership when the consumers' deposits have been repaid.

(g) This rule shall not be construed as prohibiting any utility from making free extensions of lengths greater than above specified, or from providing a method of return more favorable to consumers, so long as no discrimination is practiced between consumers whose service requirements are similar.

RULE 33. Extension of lines for rural service.—(a) A rural consumer is one whose premises are outside of the corporate limits of a municipality and one requiring an

investment per consumer's unit demand greater than is ordinarily required for consumers within municipalities.

(b) Rural consumers may arrange for electric service, provided they will compensate the utility for the fixed and operating costs of the service.

(c) Rates must not be discriminatory and because a greater investment is required per rural consumer's unit demand and greater line loss is suffered in distribution than with municipal consumers, the rates for rural service as a rule will be higher than for similar service in municipal areas. The minimum charge will also be higher because of the greater expense in meter reading and investment in consumer's service.

OKLAHOMA.

RULE 42. Extension of lines.—(a) *Free extensions.*—If an extension of a utility's distribution system should be necessary in order to serve an applicant or group of applicants whose premises are located in a municipality within which the utility is authorized to operate, the utility, upon written request for service by such applicant or applicants, shall furnish and install necessary service wires of reasonable length, including other equipment, as required in rule 41, and shall make the necessary extension to give service, provided that such line extension measured from the center of the last property being served to the center of the applicant's property, along lines of proper construction, is not a distance in excess of that occupied by one pole and span spaced according to the utility's standard practice in that locality, per individual service. Where part of the extension is made on existing poles, the utility shall make at its own expense an extension equivalent in cost to that of an average one-pole extension of new construction in that particular community.

(b) *Extension above free limit.*—If the line extension required in order to furnish service is greater than the free extension specified above, such extension shall be made under the following conditions: The utility may require a deposit of the cost of the extension above the free limit, as specified in rule 42 (a), and shall, in such a case, refund an amount equal to the cost of the free extension for each additional consumer whose service shall be taken from the extension within a period of five years from the making of such an extension, but at no time shall the rebate made exceed the original deposit.

(c) The distance of the applicant along lines of proper construction from the nearest existing secondary circuit shall be considered in determining whether he is entitled to a free extension and the cost of extending to the nearest secondary circuit, which can be extended along lines of proper engineering construction, shall be used in determining the amount of deposit necessary in case the extension is above the free limit: *Providing, however,* That extensions across streets, highways, alleys, lanes, or roads, railroads or street railway right of ways, extensions past property already being served by the utility, and extensions caused by irregularities in the city platting, shall all be made at the expense of the utility, and no part of such extensions shall be considered in arriving at the length or cost of the extension to the consumer. The cost of transformers and primary construction shall not be included nor shall the cost include the expense of making changes in the existing construction. For the purpose of this rule "property being served" shall be defined as a plat of ground or city lot of no greater dimensions than 50 by 150 feet upon which a building is located, to which the company is rendering service.

(d) Where service within a municipality can be furnished by the installation of a transformer on a primary circuit in accordance with the usual practice, the utility shall furnish service without charge, provided said applicant is within the distance of one pole and span from the transformer location.

(e) If the extension above the free limit is of such length and the prospective business which may be developed by it is so meager as to make it doubtful whether

the business from the extension would ever pay a fair return on the investment, or in case of real estate development prospects, with slight or no immediate demand for service, or in case of an industrial installation requiring expensive equipment, with slight or irregular service, the facts shall be presented to the commission for investigation and determination as to the reasonableness of such an extension. The extension shall at all times be the property of the utility, and at the end of the five-year period any unrebated portion of such advancement or deposit shall accrue to the utility as partial compensation for the maintenance and operation of such extension for said period.

(f) The utility shall not be obliged to make the extension as required by this rule unless the applicant shall furnish a suitable guarantee that he will use the service for at least one year, or unless the owner of the property served by such extension or some other responsible party shall guarantee that the service will be used for that length of time.

(g) This rule shall not be construed as prohibiting any utility from making free extension of lengths greater than above specified, or from providing a method of return of deposits for extensions more favorable to consumers, so long as no discrimination is practiced between consumers whose service requirements are similar.

NORTH DAKOTA.

RULE 31. Extension of lines.—(a) *Free extensions.*—Each utility should, upon written request for service by a prospective consumer or a group of prospective consumers located in the same neighborhood, make free of charge a line extension necessary to give service and furnish free service connection when the gross income for a period of two years from the prospective consumer or consumers is equal to the direct cost of the extension: *Provided*, That the prospects are that the patronage or demand will be of such permanency as to warrant the capital expenditure involved.

(b) *Extension above free limit.*—If the line extension required in order to furnish service at any point within the corporate limits of any city or village, or for any adjacent suburb of a city or village, which is platted, is greater than the free extension specified above, such an extension should be made under the following conditions: The utility may require a deposit of the cost of the extension above the free limit, and should in such case refund an amount equal to the cost of the free line extension for each additional consumer whose service shall be taken off of the entire extension within a period of eight years from the making of such an extension, but at no time shall the rebate made exceed the original deposit. If the extension is of such length and the prospective business which may be developed by it is so meager as to make it doubtful whether the business from the extension would ever pay a fair return on the investment, the facts may be reported to the municipality and the commission for investigation and determination as to the reasonableness of such extension. If at any time the utility desires to purchase an extension to its distribution system which was built in whole or in part by the consumer or consumers it may do so, subject to the approval of the commission, after making payment of a fair and reasonable price fixed by the commission, due allowance being made for depreciation and previous payments made thereon.

This rule shall not be construed as prohibiting any utility from making free extensions of lengths greater than above specified, or from providing a method of return of deposits for extensions more favorable to consumers, so long as no discrimination is practiced between consumers whose service requirements are similar.

(c) *Contract for service.*—Utilities should not be required to make line extensions as described in this rule unless those to be served by such extensions shall contract to use the service for at least two years.

OREGON.

Extension Rules for Electric Utilities.

URBAN TERRITORY.

RULE 1. Applicant defined.—The term "applicant" as used in these rules shall be any person or persons who shall contract to use electric service at tariff rates for a period of at least three years and be financially responsible therefor.

RULE 2. Extension defined.—(a) Urban extensions, as herein used, shall include all additions to distribution systems as limited in rule 3, built primarily to serve consumers located within the corporate limits of cities or villages or other territory which has a character and density of population generally similar to urban conditions.

RULE 3. Cost of extension defined.—(a) The cost of construction shall include all labor, material, and other expense for the distribution and installation of poles, wire, cross arms, insulators, line hardware, excluding services.

(b) Services, meters, and transformation equipment and the cost of the installation thereof shall be supplied by the utility and cost of same shall not be included in the "actual construction cost" of the extension as used herein.

(c) That part of the cost of increasing the capacity of existing lines and apparatus and that part of the cost of overbuilding of existing secondary lines with primary lines shall not be considered a part of the cost of such line extension.

(d) If the line extension required in order to furnish service necessitates the overbuilding of existing secondary lines with primary lines, or if it becomes necessary to increase the present capacity of either the primary or secondary circuits leading up to the new construction, such additional cost shall not be considered as a cost of extension under these rules.

(e) The adoption of minimum standards of construction shall prevail under these rules in so far as they will not conflict with the commission's rules and regulations governing the safe construction and operation of electric overhead systems.

RULE 4. Analysis of extensions.—Each utility shall, upon written request for electric service by a prospective consumer, or group of consumers located in the same neighborhood, make an investigation and ascertain the number who will contract for service under the terms hereinafter prescribed, and shall estimate the construction cost as outlined in rule 3, and shall also estimate the annual revenue to be derived from the extension.

RULE 5. Free extension defined.—(a) The utility shall finance and construct any extension requiring not more than one pole and one span of wires, of standard spacing, for each individual applicant.

(b) Where the extension requires more than one pole and one span of wires at standard spacing per individual applicant, the utility shall expend not less than \$60 per individual applicant.

RULE 6. Urban extensions above free limit defined.—If a line extension, required in order to furnish service to any point within the corporate limits of cities or villages or other territory which has a character and density of population generally similar to urban conditions, is greater than the free extension specified in rule 5, such an extension shall be made under the following conditions:

(a) The utility will be required to finance and construct the entire extension; and for that portion of the cost of the extension above the free limit may require the consumer or group of consumers to pay, in advance, an amount which will produce, in the form of an annuity, a sum sufficient to provide the carrying charges upon the additional investment during the development period. The annuity shall be computed at an interest rate of not less than 6 per cent. The carrying charges consist of maintenance, depreciation, taxes, and return. The maintenance, depreciation, and taxes shall be based on the actual operating costs as charged by the

utility on similar construction. The percentage of return shall be equivalent to that obtained from the utility property as a whole. Such excess extension shall be considered to have a mean effective development period of five years.

(b) If the conditions surrounding a proposed extension are such as to make it doubtful whether the business derived therefrom will ever pay a return on the investment, then, and in that event, should the utility and the prospective consumer, or consumers, be unable to adjust the basis upon which the extension will be constructed, the matter may be submitted to the commission for investigation and determination as to the reasonableness of such extension.

RULE 7. Construction of rules.—(a) The above rule shall not be construed as permitting any utility to allow additional applicants to be attached to any extension within the period of three years without such additional applicants first paying the consumer, or consumers, theretofore making advance payments on account of excess cost of the extension, a pro rata share of such advance payments, or obtaining a written waiver in lieu thereof.

(b) If the actual construction cost *exceeds* the estimated construction cost, each prospective consumer, or group of consumers, shall, upon demand, make up that difference in proportion to the amount originally advanced. If the actual construction cost is *less* than the amount collected based on the estimated construction cost, the utility shall refund the difference to the consumer, or group of consumers, in proportion to the amount paid by said consumers.

(c) The aforesaid rules shall not be construed or interpreted as prohibiting any utility from making free extensions of lengths greater than above specified so long as no discrimination is practiced between consumers whose service requirements are the same or similar.

RULE 8. Ownership defined.—All poles, wires, transformers, meters, and other equipment furnished and installed by the utility shall be and remain its sole and separate property.

And it is further ordered that rules hereinbefore set out shall continue and remain in effect for a period not less than 12 months from the effective date hereof, and continue thereafter until the further order of this commission.

And it is further ordered that jurisdiction be and hereby is retained in this case for the purpose of making such order or orders as in the opinion of the commission may be necessary and proper in the premises.

RURAL TERRITORY.

RULE 1. Definition of terms used herein.—(a) The term "consumer" shall be any person, firm, or corporation, who shall contract to use electricity at tariff rates for a period of at least five years and be financially responsible therefor.

(b) The term "rural district" shall include all of the distribution system built primarily to serve "consumers" located outside the corporate limits of cities and towns or other territory which has a character or density of population generally similar to urban conditions.

(c) The term "rural division" shall apply to any subdivision of a "rural district" receiving electric energy through a particular primary circuit.

(d) The term "rural extension" shall mean any continuous addition to a particular "rural division" constructed at any one time, and such subsequent additions thereto as comply with rule 2-d.

(e) The term "utility extension unit" shall refer to that part of a "rural extension" constructed over utility rights of way.

(f) The term "consumer extension unit" shall refer to that part of a "rural extension" constructed over consumers rights of way.

RULE 2. Cost of construction defined.—(a) *Rural extension.*—This cost shall include all labor, material, and other expense for the distribution and installation of poles,

wire, cross arms, insulators, line hardware, protective equipment, and transformers (meters excluded) used in the construction of "rural extensions."

Metering equipment shall be supplied by the utility and the cost of same shall not be included in the cost of the extension as used herein.

(b) *Utility extension unit.*—This cost shall include all labor, material, and other expense for the distribution and installation of poles, wire, cross arms, insulators, line hardware, transformers, and protective equipment used in the construction of rural lines over utility rights of way.

(c) *Consumer extension unit.*—This cost shall include all labor, material, and other expense for the distribution and installation of poles, wire, cross arms, insulators, and line hardware (meters excluded) used in the construction of rural lines over consumer rights of way.

(d) All subsequent additions to a "utility extension unit" costing, per individual "consumer," the same or less than the then outstanding average cost of the original unit, to which physical connection is made, shall be considered as a part of such "utility extension unit."

(e) Any continuous addition constructed at any one time costing more per individual "consumer" than the then outstanding average cost of the "utility extension unit" to which physical connection is made, shall be considered as a separate and distinct extension unit.

(f) The net cost of increasing the capacity of existing circuits and apparatus and the cost of overbuilding of existing secondary circuits with primary circuits shall be considered a part of the cost of "rural extensions" in accordance with rule 2(b) and 2(c).

(g) Whenever load conditions on an existing "rural division," due to increased service demands, necessitates additional line capacity on a "utility extension unit" in order to maintain adequate service, the additional investment shall be made as follows:

The utility shall finance the entire cost of such increase in line capacity; and for that part of the total net investment of the utility in the various "utility extension units" of that "rural division" in excess of two times the annual revenue to be obtained from such division, may require all of the "consumers" of such "rural division" to advance such excess cost on a pro rata basis.

(h) The adoption of standards of construction, which will reflect an ultimate minimum cost to the "consumer," shall prevail under these rules in so far as they will not conflict with the commission's rules and regulations governing the safe construction and operation of electric overhead systems. In case part of the actual construction work, hereby limited to ground work, is performed by the "consumer," such construction work must be done under the supervision of the utility furnishing the service.

RULE 3. Analysis of extension.—Each utility shall, upon written request for electric service by a prospective "consumer," or "group of consumers," located in the same neighborhood, make an investigation to ascertain the number who will contract for service under the terms hereinafter prescribed, and shall estimate the construction cost as outlined in rule 2, and shall also estimate the annual revenue to be derived from the extension. Copy of each work order estimate sheet showing in detail the estimated actual construction costs to be filed with the commission upon completion of the work.

RULE 4. Free "utility extension unit" defined.—The utility shall finance and construct, at its own expense, any "utility extension unit" where the cost of same does not exceed \$4 for each \$1 of minimum annual revenue to be obtained from such "rural extension," and in cases where the guaranteed annual revenue per "consumer" shall exceed the minimum annual revenue, the utility will be required to invest in such extension \$4 for each \$1 of guaranteed annual revenue.

RULE 5. "*Utility extension unit*" above free limit defined.—If the cost of the "utility extension unit" required in order to furnish service is greater than the free extension cost limit specified in rule 4, such an extension unit shall be made under the following conditions:

The utility will be required to finance and construct the entire "utility extension unit" and for that portion of the cost of the extension above the free limit may require the "consumer" or "group of consumers" to deposit in advance an amount equal to such "excess investment" on a pro rata basis.

RULE 6. "*Consumer extension unit*" defined.—The "consumer" or "group of consumers" will be required to finance the entire "consumer extension unit," while the actual construction work shall be performed by the utility at the expense of the "consumer." (See rule 2 (h).)

RULE 7. *Ownership and maintenance of lines*.—The arrangement as to ownership and maintenance must be such that the title to lines and equipment in "rural districts," when completed and placed in service, will rest in the utility, and the utility shall be responsible for their maintenance, operation, and replacement.

RULE 8. *Additional consumers on existing "utility extension unit"*.—In case a prospective "consumer" or "group of consumers" along an existing extension shall apply to the utility for service, such service shall be furnished provided such "consumers" shall each deposit with the utility an amount equal to the average investment per "consumer" then on deposit on the previously constructed "utility extension unit," in addition to financing their own "consumer extension unit," as per rule 6.

RULE 9. *Refunds to "consumers"*.—Within two months after the completion of each addition to a "utility extension unit," the utility shall refund on a pro rata basis to all "consumers" of such unit that part of the sum of the amount deposited by the additional "consumers" (see rule 8) and the utility (see rule 4) which is in excess of the actual cost of the additional construction.

RULE 10. *Charges for rural service—Regular rates*.—The regular tariff rates for rural service on file with the commission and in force at the time for any service performed by the utility shall apply under these rules.

RULE 11. *Accounting requirements affecting "utility extension unit"*.—(a) The unfunded amounts of "consumer" deposits outstanding on "rural extensions" shall be shown on the utility's balance sheet, in the annual report to the commission, as a deferred credit item. This balance sheet account or appropriate subaccounts shall be so kept as to show separately the investments in "utility extension units" and "consumer extension units."

(b) No "consumer" or his successor in the ownership of the property served shall be refunded more than the excess payments advanced under rule 5. When all advance payments on any "utility extension unit" have been refunded, such extension unit will be considered as finished and no further accounting will be necessary.

RULE 12. *Construction of rules*.—(a) If the actual construction cost exceeds the estimated construction cost, each prospective "consumer" shall, upon demand, make up that difference. If the actual construction cost is less than the amount collected on the basis of the estimated construction cost, the utility shall refund the difference to the "consumer" or "group of consumers" in proportion to the amount paid by said "consumers."

(b) The aforesaid rules shall not be construed or interpreted as prohibiting any utility from making free extensions requiring greater proportionate investment than above specified so long as no discrimination is practiced between "consumers" whose service requirements are the same or similar.

(c) If the conditions surrounding a proposed extension are such as to make it doubtful whether the business derived therefrom will ever pay a return on the investment, then and in that event should the utility and the prospective consumer or consumers be unable to adjust the basis upon which the extension will be constructed, the matter

may be submitted to the commission for investigation and determination as to the reasonableness of such extension.

SOUTH CAROLINA.

RULE 27. Extensions.—Each utility shall adopt rules, subject to the approval of the commission, under which it will, upon written request for service by prospective consumers, located in the same neighborhood, make the extension necessary to give service and furnish service connection or connections.

FILE OF SCHEDULE OF RATES, RULES, AND REGULATIONS.

COLORADO.

RULE 12. Filing of rate schedules, rules, and regulations.—(a) Copies of all schedules of rates for service, forms of contracts, charges for service connections and extensions of lines, and of all rules and regulations covering the relations of consumer and utility, shall be filed by each utility in the office of this commission. Complete schedules, contract forms, rules, and regulations, etc., as filed with the commission, shall also be on file in the local office of the utility, and shall be open to the inspection of the public.

(b) A copy of this order shall likewise be on file in the office of the utility and open to the inspection of the public.

(c) The attention of the public shall be called to these files of schedules, rules, and regulations and orders, by placing a suitable placard in the office of the utility.

(d) If the reasonableness of any charge, rule, regulation, or practice of any utility with reference to service connections or extensions, or of any rule covering the relations between consumer and utility, is challenged, the commission will, upon complaint and investigation, prescribe the proper charge, rule, regulation, or practice which shall thereafter be followed.

RULE 15. Practice under these rules to be filed.—Each utility shall file with this commission within four months after receipt of this order, a statement, typewritten, properly identified and dated, on 8½ by 11 inch sheets, describing its practice under these rules as follows:

(a) Description of test methods employed and frequency of tests or observations for determining quality, voltage, and pressure of gas, electric, and water service furnished.

(b) Description of meter-testing equipment including methods employed to ascertain and maintain accuracy of all testing equipment.

(c) Rules covering testing and adjustment of service meters when installed and periodic tests after installation.

Revisions in any portion of this statement after filing will necessitate the filing of an entire new statement, properly identified and dated, canceling the one on file.

INDIANA.

RULE 32. File of rate schedules, rules and regulations of the utility and of the commission.—(a) Copies of all schedules of rates for service, forms of contracts, charges for service connections and extensions of lines, and of all rules and regulations covering the relations of consumers and utility shall be filed by each utility in the office of the commission. Complete schedules, contract forms, rules, and regulations, etc., as filed with the commission, shall also be on file in the local office of the utility, and shall be open to the inspection of the public.

(b) It is recommended that a copy of the rules and regulations for electric service as published and furnished by the Public Service Commission should be on file and open to the inspection of the public.

(c) It is recommended that the attention of the public be called to these files of schedules, rules, and regulations, by placing a suitable placard in the office of the utility.

MICHIGAN.

57. *Filing of utility's regulations.*—Copies of all regulations promulgated by any utility concerning the relations and transactions between the consumers and such utility, shall be filed by each utility in the offices of the commission, in accordance with the regulations prescribed by the commission.

58. *Filing of commission's rules.*—A copy of these rules regarding standards of electrical service to consumers, as published and furnished by the commission, shall be kept on file and open to the inspection of the public at all times, and a suitable placard shall be placed in the offices of the utility wherein consumers' bills are payable, calling the attention of the public to the fact that these rules are so filed and open to inspection.

56. *Filing of rate schedules.*—Copies of all schedules of rates for service, cash deposits, and charges for service connections and line extensions, and copies of all contract forms, shall be filed by each utility in the offices of the commission, in accordance with the regulations prescribed by the commission.

MISSOURI.

RULE 13. The practice of any utility covering deposits or guaranties of surety, together with interest paid upon cash deposits, must be filed with the commission as a portion of the utility's schedule of rates under the provisions of the commission's general orders covering the filing and publication of rate schedules.

The practice governing service main extensions by any utility must likewise be filed with the commission as a portion of the schedule of rates on file.

Each utility should file with the commission, within 90 days after receipt of this order, a statement, typewritten, properly identified and dated, on 8½ by 11 inch size sheets, describing its practice under these rules covering:

(a) Description of test methods employed and frequency of tests or observations for determining quality, voltage, and pressure of gas, electric, and water service furnished.

(b) Description of meter-testing equipment, including methods employed to ascertain and maintain accuracy of all testing equipment.

(c) Rules covering testing and adjustment of service meters when installed and periodic tests after installation.

(d) Rules covering adjustment of consumers' bills for incorrect meter registration.

Revisions in any portion of this statement after filing will necessitate the filing of an entire new statement, properly identified and dated, canceling the one on file. Any such change must receive the consent of the commission in writing before becoming effective.

MONTANA.

RULE 8. *Rate schedule, rules and regulations.*—(a) Copies of all schedules of rates for service, forms of contract, rules, and regulations covering the relations of consumer and utility shall be filed by each utility in the office of the commission. Complete schedules, contract forms, rules, and regulations, etc., as filed with the commission shall also be on file in the local office of the utility, and shall be open to the inspection of the public.

(b) It is recommended that extra copies of rules and regulations for electric service as published and furnished by the Public Service Commission be kept on hand in the office of each utility, and handed to consumers upon request.

NORTH DAKOTA.

RULE 32. *File of rate schedules, rules and regulations of the utility and of the commission.*—(a) Copies of all schedules of rates for service, forms of contracts, charges for service connections and extensions of lines, shall be filed by each utility in the

office of the commission. Complete schedules, contract forms, etc., as filed with the commission, shall also be on file in the local office of the utility, and shall be open to the inspection of the public.

(b) All rules and regulations covering the relations of consumer and utility, formulated by such utility, shall be filed in the office of the commission, subject to the approval of the commission before being enforced.

(c) It is recommended that a copy of the rules and regulations for electric service as published and furnished by the Board of Railroad Commissioners should be on file and open to the inspection of the public.

(d) It is recommended that the attention of the public be called to these files of schedules, rules and regulations by placing a suitable placard in the office of the utility.

OKLAHOMA.

RULE 25. *Filing of rate schedules, rules and regulations of the utility and of the commission.*—(a) Copies of all schedules of rates for service, forms of contracts, charges for service connections and extensions of lines, and of all rules and regulations covering the relations of consumers and utility shall be filed by each utility in the office of the commission. Complete schedules, contract forms, rules and regulations, etc., as filed with the commission, shall also be on file in the local office of the utility.

(b) A current copy of the rules and regulations for electric service as published and furnished by the commission, shall be on file and open to the inspection of the public. With this shall be a copy of the most recent rate schedule, complete, with the utility's rules and regulations governing service connections, extension of lines, or any rule covering the relations between utility and consumer. To be authentic each of the above-mentioned rate schedules, rules, and regulations must be approved by the commission, and at least one copy on file with the company must contain the commission's official stamp of approval.

(c) The attention of the public shall be called to these files of schedules, rules, and regulations, by placing a suitable placard in the office of the utility, where it can be easily seen by consumers who enter said office.

(d) If the reasonableness of any charge, rule, regulation, or practice of any utility with reference to service connections or extensions, or of any rule covering the relations between consumer and utility, is challenged, the commission will, upon complaint and investigation, prescribe the proper charge, rule, regulation, or practice which shall thereafter be followed.

SOUTH CAROLINA.

RULE 28. *Rate schedule—Rules and regulations.*—(a) Copies of all schedules of rates for service, forms or contracts, charges for service connections and extensions of circuits, and of all rules and regulations covering the relations of consumer and utility, shall be filed by each utility in the office of the commission. Complete schedule, contract, forms, rules and regulations, etc., as filed with the commission, shall also be on file in the local offices of the utility, and shall be open to the inspection of the public.

(b) Each utility shall submit to the commission and have on file in its office, its schedule of rates showing the rates charged for each class of service, and each and every customer purchasing the same class of service shall be charged the same rates, which shall be the regular published rates for that class of service. No consumer purchasing any particular class of service shall be discriminated against in favor of another customer purchasing the same class of service, except that if there appears to the utility a good and sufficient reason why a certain customer should have a special rate and will submit the facts to the commission, it will make a ruling in the matter.

WEST VIRGINIA.

RULE 22. *Filing of rate schedules, rules and regulations.*—Copies of all schedules of rates for service and other charges, and of all rules and regulations covering the relations of consumer and utility, shall be filed by every utility in the office of the commission. All such schedules, rules, and regulations shall be kept on file in the office of the utility, and shall be open to the inspection of the public. No such rules and regulations, schedules of rates, or charges, shall take effect until so filed with the commission.

RULE 21. *Posting of law, rates, rules and regulations of utility and commission.*—Every utility shall provide a suitable table or desk in the outside office, near the cashier's window, to which shall be kept securely fastened by a suitable chain the following:

(1) A copy of the rates, forms of contracts and applications, and rules and regulations of the utility applying to the territory served from that office.

(2) A copy of the law of the State governing public-service utilities.

(3) A copy of the rules and regulations adopted by the Public Service Commission governing public-service utilities.

(4) A suitable placard in large type shall be placed above the said desk or table, notifying the public that a copy of the law, and the rules and regulations, and rates of the utility and rules and regulations of the Public Service Commission, are here kept for their information.

FRAUDULENT USE.

ARIZONA.

RULE 21. Any utility supplying gas and electricity, who detects the fraudulent use of gas and electricity by a consumer, may discontinue the service, and need not reinstate same until an amount shall be paid to the utility covering the estimated amount of such commodity fraudulently used, and a charge of \$2 to cover extraordinary expenses incidental thereto. In such cases the utility shall estimate the amount of gas or electricity fraudulently used, from previous or subsequent meter readings, or other proper data.

MONTANA.

RULE 10. (d) All meters will be sealed by the utility. The breaking of seals by unauthorized persons, tampering with wires, meters, or cut-outs is prohibited by law.

Sec. 8659, penal code provides: Every person who, with intent to injure or defraud, procures, makes, or causes to be made, any pipe, tube, wire, or other conductor of gas or electricity, and connects the same, or causes it to be connected, with any main, service pipe, or other pipe for conducting or supplying illuminating gas or any wires or other conductor of electricity, in such manner as to supply illuminating gas or electricity to any lamp, motor, burner, or orifice, by or at which illuminating gas or electricity is consumed, around or without passing through the meter provided for the measuring and registering the quantity consumed, or in any other manner so as to evade payment therefor, and every person who, with like intent, injures or alters any gas or electric meter, or obstructs its action, is guilty of a misdemeanor. In prosecution for offenses under this section, proof that, any of the acts herein forbidden have been done in, upon, or about the premises owned or used by the defendant charged with the commission of such offense in such a manner as to decrease or lessen the amount he should pay under his understanding or contract with any person or corporation engaged in the business of furnishing and selling gas or electricity, shall be prima facie evidence of the guilt of said defendant. (Act approved March 6th, 1897.) (5th Sess. 248.)

OKLAHOMA.

RULE 38. *Tampering with measuring instruments or equipment.*—No regulating or measuring instrument or other property and equipment owned by the utility, whether situated upon a consumer's premises or elsewhere, shall be tampered with or interfered with either for the purpose of adjustment or otherwise, except by authorized and accredited representatives of the utility owning the same; and official responsibility under a municipal government shall not constitute an exemption from this rule. A violation of this provision shall authorize the utility to discontinue service pending adjustment before the commission.

FREQUENCY VARIATIONS.**CONNECTICUT.**

RULE E-7. *Standard frequency.*—(a) Each utility supplying alternating current shall adopt a standard frequency for its system, or for any subdivisions into which the system may be divided, the suitability of which may be determined by the commission, and shall maintain this frequency to within 5 per cent above and 5 per cent below the standard.

INDIANA.

RULE 22. *Standard frequency.*—Each utility supplying alternating current shall adopt a standard frequency, the suitability of which may be determined by the commission, and shall maintain this frequency within 5 per cent, plus or minus, of standard at all times during which service is supplied: *Provided, however,* That momentary variations of frequency of more than 5 per cent, which are clearly due to no lack of proper equipment or reasonable care on the part of the utility, shall not be considered a violation of this rule.

ILLINOIS.

RULE 20. *Standard frequency.*—Each utility supplying alternating current shall adopt a standard frequency for its system, or for any division thereof, and shall maintain this frequency within 5 per cent of standard at all times during which service is supplied: *Provided, however,* That momentary variations of frequency of more than 5 per cent, which are clearly due to no lack of proper equipment or reasonable care on the part of the utility, shall not be considered a violation of this rule.

MARYLAND.

3. Each utility supplying alternating current shall endeavor to maintain the standard frequency at a constant value; the variation from such standard frequency shall not be greater than 5 per cent at all times during which service is supplied. Momentary variations of frequency of more than 5 per cent which are clearly not due to lack of proper equipment or reasonable care in operation, shall not be considered a violation of this rule. No condition shall be allowed to maintain which contributes to even momentary variations of as much as 10 per cent.

MICHIGAN.

48. *Standards of frequency.*—Each utility supplying alternating current shall adopt definite standards of "normal" frequency subject to the approval of the commission, and shall maintain these frequencies within 5 per cent of standard at all times during which service is supplied: *Provided, however,* That momentary variations in frequency greater than 5 per cent, which are not due to lack of reasonable care on the part of the utility in the selection and operation of equipment, shall not be considered a violation of this rule.

MONTANA.

RULE 4. Standard frequency.—(a) Each utility supplying alternating current shall adopt a standard frequency, the suitability of which may be determined by the commission, and shall maintain this frequency within 5 per cent, plus or minus, of standard at all times, during which service is supplied: *Provided, however,* That momentary variations of frequency of more than 5 per cent, which are clearly due to no lack of proper equipment or reasonable care on the part of the utility, shall not be considered a violation of this rule.

(b) If a utility shall change its standard of frequency, it shall give reasonable notice to all its consumers, and shall make tests and readjust all watthour meters as soon thereafter as practicable, and shall refund to the consumers all the excess charges which may have been collected from him by reason of the change of frequency.

NEW HAMPSHIRE.

RULE 14-A. Standard frequency.—Every utility supplying alternating current shall adopt a standard frequency or frequencies, the suitability of which may be determined by the commission, and shall maintain this frequency within 5 per cent, plus or minus, of the standard at all times during which service is supplied: *Provided, however,* That momentary variations of frequency of more than 5 per cent; which are clearly due to no lack of proper equipment or reasonable care on the part of the utility, shall not be considered a violation of the rule. (Effective May 1, 1920.)

NORTH DAKOTA.

RULE 22. Standard frequency.—Each utility supplying alternating current shall adopt a standard frequency, the suitability of which may be determined by the commission, and shall maintain this frequency within 10 per cent plus or minus, of standard at all times during which service is supplied: *Provided, however,* That momentary variations of frequency of more than 10 per cent which are clearly due to no lack of proper equipment or reasonable care on the part of the utility, shall not be considered a violation of this rule.

OKLAHOMA.

RULE 27. Standard frequency.—Each utility supplying alternating current shall adopt a standard frequency for its system, or for any division thereof, and shall maintain this frequency within 5 per cent of standard at all times during which service is supplied: *Provided, however,* That momentary variations of frequency of more than 5 per cent, which are clearly due to no lack of proper equipment or reasonable care on the part of the utility, shall not be considered a violation of this rule.

PENNSYLVANIA.

RULE 4. Standard frequency.—Each utility supplying alternating current shall adopt a standard frequency, the suitability of which may be determined by the commission, and shall maintain this frequency within 5 per cent, plus or minus, of standard at all times during which service is supplied: *Provided,* That momentary variations of frequency of more than 5 per cent, which are clearly due to no lack of proper equipment or reasonable care on the part of the utility, shall not be considered a violation of this rule.

NO. 23. Change of frequency.—If a utility shall change its standard of frequency, it shall give reasonable notice to all its consumers, and shall make tests and shall readjust all watthour meters as soon thereafter as practicable, and shall refund to the consumer all the excess charges which have been collected from him by reason of the change of frequency.

SOUTH CAROLINA.

RULE 20. *Standard frequency.*—Each utility supplying alternating current shall adopt a standard frequency, the suitability of which may be determined by the commission, and shall maintain this frequency within 5 per cent, plus or minus, of standard at all times during which service is supplied: *Provided, however,* That momentary variations of frequency of more than 5 per cent, which are clearly due to no lack of proper equipment or reasonable care on the part of the utility, shall not be construed a violation of this rule.

WEST VIRGINIA.

RULE 25. *Standard frequency.*—Every utility supplying alternating current shall adopt a standard frequency, the suitability of which may be determined by the commission, and shall maintain this frequency to within 5 per cent above and 5 per cent below the standard at all times.

GROUNDING OF SECONDARIES.

COLORADO.

RULE 30. *Grounding of low-potential circuits.*—The rules currently in force contained in the National Electrical Safety Code regarding grounding of low-potential circuits shall be followed for all new construction. Each utility shall adopt a plan whereby existing circuits will be grounded in conformity with this rule, and submit the same to this commission for approval not later than June 1, 1917.

CONNECTICUT.

RULE E-5. *Grounding of low-potential circuits.*—(a) The rules contained in the current edition of the National Electrical Code regarding the grounding of low-potential circuits shall be followed for all new connections. Each utility shall adopt a plan whereby existing ungrounded circuits shall be changed to conform to this rule, and submit the same to the commission for approval not later than October 1, 1915.

(b) Where local conditions make the complete observance of these requirements impracticable, the statement of such conditions shall be made to the commission in writing.

ILLINOIS.

RULE 21. *Groundings of secondaries.*—Transformer secondaries shall be grounded in accordance with the rules contained in the current edition of the National Electrical Code.

It is recommended that ground connections be made to water pipes within buildings wherever such pipes are available. Such connections should be so located that the blowing of a fuse will not cause a loss of the ground connections. A record of the locations of such grounds should be kept in the company's office.

In the entire absence of a water-piping system, a ground pipe, plate, or other suitable artificial ground shall be provided outside the building. Each transformer secondary which supplies more than one building should be provided with at least two ground connections. Grounds made outside of buildings shall be periodically inspected and maintained in good physical condition. Secondaries of transformers temporarily installed shall be grounded.

INDIANA.

RULE 29. *Grounding of low-potential circuits.*—The rules contained in the last edition of the National Electric Safety Code regarding the grounding of low-potential circuits shall be observed on all new construction. Each utility shall adopt a plan whereby existing construction shall be made to conform to the rules as expeditiously as possible.

NEW JERSEY.

XIV. The rules contained in the 1913 edition of the National Electrical Code regarding grounding of secondaries are hereby adopted for all new construction. Each utility shall adopt a plan whereby existing services will be changed to conform to the rule, and submit the same to the board for approval by July 1, 1914.

NEW YORK.^a

Grounding.—1. The grounding of low-potential circuits under the following regulations is only allowed when such circuits are so arranged that under normal conditions of service there will be no appreciable passage of current to ground.

2. Transformer secondaries of distributing systems (except where the primary voltage does not exceed 600 volts) must be grounded provided the maximum difference of potential between the grounded point and any other point in the circuit does not exceed 150 volts and may be grounded when the maximum difference of potential between the grounded point and any other point in the circuit exceeds 150 volts. In either case, the following rules must be complied with: (a) The grounding shall be made at the neutral point or wire, whenever a neutral point or wire is accessible; (b) when no neutral point or wire is accessible, one side of the secondary circuit shall be grounded; and (c) the ground connection shall be at the transformer or on the individual service or on a system ground wire connected to the grounded conductors of many secondary mains.

3. Ground wires shall be copper and never less than No. 6 B. & S. gage, and have an approved insulating covering.

4. The ground conductors for three-phase systems must not be smaller than one-fifth the size of the wire to which it is attached nor smaller than No. 6 B. & S. gage copper wire, and need not be larger than No. 0 B. & S. gage copper wire.

5. The cases or frames of transformers used exclusively to supply current to meters shall be grounded unless they are installed and guarded in all respects as required for the higher voltage circuit connected to them.

6. Ground connections to metallic piping systems should be made on the street side of water meters, but connections may be made immediately inside building walls to secure accessibility for inspection and test. When water meters are located outside buildings, or in concrete pits within buildings where piping connections are imbedded in concrete flooring, the ground connections may be made on the building side of the meters, if they are suitably shunted.

NORTH DAKOTA.

RULE 29. *Grounding of low-potential circuits.*—The rules contained in the last edition of the National Electrical Safety Code as promulgated by the Bureau of Standards regarding the groundings of low-potential circuits shall be observed on all new constructions. Each utility shall adopt a plan whereby existing construction shall be made to conform to the rules as expeditiously as possible.

OKLAHOMA.

RULE 10. *Grounding of low-potential circuits.*—(a) The rules currently in force contained in the National Electrical Safety Code, regarding grounding of low-potential circuits, shall be followed for all new construction.

(b) Each utility shall adopt a plan whereby existing ungrounded circuits will be grounded in conformity with this rule, and submit the same to the commission for approval by July 1, 1922.

^a See also Order No. 2062, which concerns grounding of equipment in central stations.

(c) Each transformer secondary which supplies more than one building shall be provided with at least two ground connections. Grounds made outside of buildings shall be periodically inspected and maintained in good physical condition. Secondaries of transformers temporarily installed shall be grounded.

(d) It is recommended that ground connections be made to water pipes whenever such pipes are available. Such connections should be so located that the blowing of a fuse will not cause a loss of the ground connections.

(e) In the entire absence of a water-piping system, a ground-pipe plate, or other suitable artificial ground, shall be provided outside the building.

(f) When resort must be had to artificial grounds, their number shall be determined by the following requirements:

(1) Not more than one such ground is required for lightning arresters, except where for large current capacity. At least two grounds are required for low-voltage alternating-current distribution circuits, at transformers or elsewhere.

(2) Where no part of the circuit or equipment protected can be reached by persons while they are standing on the ground or damp floors, or by persons while touching any metallic piping to which the ground is not effectively connected, a single artificial ground may be used * * *.

(g) Artificial grounds shall be located where practicable below permanent moisture level, or failing this, at least 6 feet deep. Each ground shall present not less than 2 square feet of surface to exterior soil. Areas where ground-water level is close to the surface shall be used when available.

WEST VIRGINIA.

RULE 7. Grounding of low-potential circuits.—The rules contained in the current edition of the National Electrical Code regarding grounding of low-potential circuits shall be followed for all new construction. Every utility shall adopt a plan whereby existing service shall be changed to conform to this rule, and submit the same to the commission for approval by January 1, 1917.

INFORMATION FOR CUSTOMERS AS TO SERVICE.

COLORADO.

RULE 9. Information for consumers.—(a) Each utility shall at any time, on request, give its consumers such information and assistance as is reasonably possible in order that consumers may secure safe and efficient service, and may secure lamps and appliances properly adapted to the service furnished. Each utility shall inform each consumer of any such change made or proposed to be made in any condition as to its service as would affect the efficiency of the service or the operation of the appliances or equipment which may be in use by said consumer.

(b) Each utility supplying metered service shall adopt some means of informing its consumers as to the method of reading meters, either by printing on its bills a description of the method of reading meters, or a notice to the effect that the method will be explained upon application. It is recommended that an exhibition meter be kept on display in each commercial office maintained by a utility.

CONNECTICUT.

RULE E-10. Information service.—(a) Each utility shall specifically inform its customers as to the conditions under which efficient and economical service may be secured from its system, and render its customers reasonable assistance in securing incandescent lamps and other appliances best adapted to the service furnished.

ILLINOIS.

RULE 23. *Information to consumers.*—(a) Bills rendered periodically to consumers for metered service shall show the date and the reading of the meter at the beginning and end of the period for which the bill is rendered, the energy used, and the rate per kilowatthour. On all bills which are computed on any other basis than a definite charge per kilowatthour, the other factors used in computing the bill shall be clearly stated so that the amount may be readily computed from the information appearing upon the bill.

(b) Each utility shall, upon request, specifically inform any consumer as to the conditions under which efficient and economical service may be secured from its system, and shall render reasonable assistance in securing lamps, motors, and appliances best adapted to the service furnished. Where one class of service is available through only a part of the district served, or is available only at certain times of day or night, full information shall be furnished a prospective consumer in connection with an application for such service.

(c) On written request by a customer, the utility shall cause the meter reader at the time the customer's meter is read to leave on such meter a card showing the date and time such reading was made, and the reading expressed in kilowatthours.

MARYLAND.

J. Each utility shall give to its consumers such information and assistance as is reasonably possible, in order that consumers may secure safe and efficient service and may purchase lamps and appliances properly adapted to the service furnished. Each utility shall inform each consumer of any change made or proposed to be made in any condition of its service that would affect the safety of operation, or would require changes in or adjustment of the appliances or equipment which may be in use by said consumer. Each utility supplying metered service shall adopt means to inform its consumers as to the method of reading meters, in some form to be readily understood by the consumer.

It is recommended that an exhibition meter be kept on display in each commercial office maintained by a utility.

MISSOURI.

RULE 10. Utilities shall, upon request, use their best efforts to inform consumers as to the conditions under which efficient service may be secured from their system and render consumers reasonable assistance in securing the various fixtures, motors, lamps, and appliances best adapted to the service furnished.

NEVADA.

RULE 24. Each company supplying electrical energy for incandescent illumination shall, upon request, specifically inform its consumers as to the conditions under which efficient and economical illuminating service may be secured from its system.

NEW HAMPSHIRE.

RULE 13. Each utility supplying electric service shall, upon application, inform any of its consumers as to the conditions under which efficient service may be secured from its system, and render its consumers reasonable assistance in securing incandescent lamps and other appliances best adapted to the service furnished. It shall adopt some method of informing its consumers as to the reading of meters by printing on bills either a description of such method or a notice to the effect that the method will be explained on application to the utility meter reader. Where meters for more than one consumer are installed in proximity to each other, each meter shall be marked or tagged with the name of the consumer whose service is measured thereby.

NEW JERSEY.

No. 10. Each utility supplying electrical energy for incandescent illumination shall specifically inform each of its customers, where unusual conditions prevail, as to the conditions under which efficient illuminating service may be secured from its system.

No. 11. Each utility shall furnish to any prospective customer, on request, a statement of the kind or kinds of service available, giving the adopted voltage, nature of current, and, if alternating current, the frequency and number of phases. Where one class of service is available through only a part of the district served this should be stated in connection with any such application. Where service is available only at certain times of day or night full information must be readily available to all prospective customers or their representatives.

Where unusual conditions prevail each utility supplying electrical energy for power shall specifically inform each of its customers as to the conditions under which efficient and satisfactory service may be secured from its system. When, on account of its size and character, the apparatus desired to be connected to the lines of utility is so unusual as to affect the adequacy of the service furnished to other customers, prospective or otherwise, the conditions may require special provision for the load in question. This applies particularly to such connections as grounded signal system, medical apparatus, welding machines, large motors, large-capacity arc lamps, furnaces, moving-picture machines, wireless-telegraph apparatus, etc. In all cases, however, it is understood that the utility is merely a supplier of its commercial standard electrical energy deliverable at the customer's service cut-out under certain conditions as to pressure, continuity, and regularity.

OREGON.

RULE 11. *Information to customers.*—Every utility shall specifically inform its customers as to the conditions under which efficient service may be secured from its system, and render its customers reasonable assistance in securing lamps or other appliances best adapted to the service furnished.

OKLAHOMA.

RULE 24. *Information as to kinds of service.*—Each utility shall, on request of any consumer or prospective consumer, furnish a statement of the kind or kinds of service available, giving the standard voltage, nature of current, and, if alternating current, the frequency and number of phases. Where one class of service is available through only a part of the district served, this shall be stated in connection with any such application. Where service is available only at certain times of day or night, full information shall be readily available to all prospective consumers or their representatives.

RULE 21. *Information as to reading of meters.*—(a) Each utility supplying metered service shall adopt some method of informing its consumers how watthour, meters are read, either by printing on bills a description of the method of reading meters, by distributing booklets or folders describing the method, or by notice to the effect that the method will be explained on application. In addition to this, it is recommended that an exhibition meter be kept on display in each commercial office maintained by a utility.

(b) Each service meter shall indicate clearly the kilowatthours for which charge is made to the consumer. In case where the dial reading of a meter must be multiplied by a constant to obtain the units consumed, the proper constant to be applied shall be clearly marked on the face or dial of the meter.

RULE 22. Information on bills.—(a) Bills rendered periodically by each utility supplying metered service shall show, in addition to the net amount due, the dates on which the readings were taken, the meter readings, and all other essential facts upon which the bill is based. On all bills which are computed on any other basis than a fixed charge per kilowatthour, the other factors used in computing the bill shall be clearly stated so that the amount may be readily computed from the information appearing upon the bill. Each bill shall bear upon its face the date the bill was mailed to, or left at the premises of the consumer, the latest date on which it may be paid without loss of discount or incurring of penalty, the date when service will be discontinued for nonpayment of said bill and the charge that will be made for restoring service.

(b) Upon written request by a consumer the utility shall cause the meter reader at the time the consumer's meter is read to leave on such meter a card showing the date and time such reading was made and the reading expressed in kilowatthours.

SOUTH CAROLINA.

RULE 10. Information for consumers.—(a) Each utility shall, upon request, give its consumers such information and assistance as is reasonable in order that consumers may secure safe and efficient service; and, upon request, it shall render every reasonable assistance in securing appliances properly adapted and adjusted to the service furnished.

(b) Each utility shall adopt some means of informing its consumers as to the method of reading meters, either by printing on its bills a description of the method or reading meters or by a notice to the effect that the method will be explained at the office of the utility, upon application. It is recommended that an exhibition meter be kept on display in each office maintained by a utility.

WISCONSIN.

RULE 27. Each utility supplying electric service shall specifically inform each of its consumers as to the conditions under which efficient service may be secured from its system and render its consumers reasonable assistance in securing incandescent lamps and other appliances best adapted to the service furnished.

WEST VIRGINIA.

RULE 23. Information as to kinds of service.—(a) Every utility shall, on request of any consumer or prospective consumer, furnish a statement of the kind or kinds of service available, giving the standard voltage, nature of current, and, if alternating current, the frequency and number of phases. Where one class of service is available through only a part of the district served this should be stated in connection with any such application. Where service is available only at certain times of day or night full information must be readily available to all prospective consumers or their representatives.

(b) Where unusual conditions prevail every utility supplying electricity for power shall specifically inform each of its consumers as to the conditions under which efficient and satisfactory service may be secured from its system. If other service better suited to the needs of the consumers may be secured by the use of more energy or otherwise, consumers should be so informed.

(c) Every utility shall have the option of refusing to furnish polyphase current for motors of less capacity than five horsepower.

INFORMATION FOR CUSTOMERS AS TO METER READINGS.

COLORADO.

RULE 10. (b) Each utility shall, upon written request of any consumer, cause the meter reader reading the meter installed upon the premises of such consumer to leave upon such a meter a card or slip showing the date and time such reading was taken,

and either the total reading expressed in cubic feet, kilowatthours, gallons, or other unit of service recorded by the meter read, or showing the position of the hands upon the dial of such meter at the time the reading was taken.

MARYLAND.

K. 3. Each utility having prepayment meters in service shall at the end of each collection period inform the consumer of the reading of the meter, as well as the amount of money taken from the meter for the period corresponding to the meter reading.

MISSOURI.

RULE 8. Each utility shall, upon written request of any consumer, cause the meter reader reading the meter installed upon the premises of such consumer, to leave upon such meter a card or slip showing the date and time such reading was taken, and either the total reading expressed in cubic feet, kilowatthours, gallons, or other unit of service recorded by the meter read, or showing the position of the hands upon the dial of such meter at the time the reading is taken.

NEVADA.

RULE 26. Gas and electric companies shall furnish printed instructions as to the method of reading meters, and post copies of the same in a conspicuous place near the meter. They shall also have their meter readers instruct all customers in the correct method of reading their meters, and shall have their meter readers present to customers at the time meter is read a duplicate record of his reading which shall give the present reading, the previous reading, the consumption for the month just passed, the consumption for the previous month, and the dates of readings.

NEW JERSEY.

No. 29. Each utility supplying electrical energy shall adopt some method of informing its customers as to the reading of meters either by printing on bills a description of the method of reading meters, or a notice to the effect that the methods will be readily explained on application. *It is recommended that an exhibition meter be kept on display in each commercial office maintained by the electric utility.*

OREGON.

No. 7. (c) On written request by a customer, the utility shall cause the meter reader at the time the customer's meter is read to leave on such meter or with the customer, a card showing the date and time such reading was made, and the reading of the meter expressed either in cubic feet, gallons, kilowatthours, or other unit of service upon which the charge is made, or the position of the hands on the meter dial.

WASHINGTON.

RULE 7. Each company supplying gas, electric current, or water within the State shall, upon written request of any consumer, cause the meter reader reading the meter installed upon the premises of such consumer, to leave upon such meter a card showing the date and time such reading was taken and either the total reading expressed in cubic feet, kilowatthours, gallons, or other unit of service recorded by the meter read, or showing the position of the hands upon the dial of such meter at the time the reading is taken.

WEST VIRGINIA.

RULE 18. *Information as to reading of meters.*—Every utility supplying metered service shall adopt some method of informing its consumers how watt-hour meters are read either by printing on bills a description of the method of reading meters, by distributing booklets or folders describing the method, or by notice to the effect that the method will be explained on application.

INCANDESCENT LAMPS AND LIGHTING.

COLORADO.

RULE 41. *Inspection of incandescent lamps.*—Each utility supplying electricity for incandescent lighting shall inspect, in a general way, the incandescent lamps of each consumer, to whom free lamp renewals are supplied, at least once every two years, and render its consumers reasonable assistance in securing incandescent lamps and other appliances best adapted to the service furnished. It should also see that lamps furnished consumers without charge or at prices less than the open market prices, shall be of such efficiency in watts per candle when used on the utility's circuits of standard voltage as defined in rule 31, that the cost of light per candlepower hour to consumers will not exceed the cost per candlepower hour when incandescent lamps of like type are bought in the open market.

INDIANA.

RULE 20. *Incandescent lighting.*—It is recommended (a) that each utility supplying electrical energy for incandescent lighting should render its consumers reasonable assistance in securing incandescent lamps and other appliances best adapted to the service furnished; (b) that lamps furnished by utilities to consumers without charge (free renewals), or at prices less than open-market prices, should be of such efficiency in watts per candle, when used on the utility's circuits of standard voltage, so that consumers may obtain their lighting service under the most favorable conditions practicable under the rate schedule.

MARYLAND.

J-1. Lamps furnished by utilities to consumers without charge (free renewals) or at prices less than open-market prices, should be of such efficiency in watts per candle when used on the utility's circuits of standard voltage as defined in special rule 2, that the cost of light per candlepower hour will not exceed the cost per candlepower hour, when similar lamps are bought in the open market.

MICHIGAN.

39. *Incandescent lamps.*—Each utility supplying electricity for incandescent lighting shall render to its consumers reasonable assistance in securing incandescent lamps and other appliances of such quality and rating as are best adapted to the service furnished.

40. Incandescent lamps furnished by utilities to consumers either with or without charge shall be of such quality, rating, and efficiency when used on the circuits of the utility, that consumers may obtain their lighting service under the most favorable conditions with the prevailing schedule of rates.

NEW JERSEY.

No. 9. Each utility supplying electrical energy for incandescent illumination shall inspect in a general way the incandescent lamps of each consumer to whom free lamp renewals are supplied at least once in two years, and render its consumers reasonable assistance in securing incandescent lamps best adapted to the service furnished.

NORTH DAKOTA.

RULE 20. *Incandescent lighting.*—It is recommended (a) that each utility supplying electrical energy for incandescent lighting should render its consumers reasonable assistance in securing incandescent lamps and other appliances best adapted to the service furnished; (b) that lamps furnished by utilities to consumers without charge

(free renewals) or at prices less than open-market prices, should be of such efficiency in watts per candle, when used on the utility's circuits of standard voltage, so that consumers may obtain their lighting service under the most favorable conditions practicable under the rate schedule.

OKLAHOMA.

RULE 23. Incandescent lighting.—(a) Each utility supplying electrical energy for incandescent lighting shall render its consumers proper advice in securing incandescent lamps and other appliances best adapted to the service furnished.

(b) Lamps furnished by utilities to consumers without charge (free renewals), or at prices less than open-market prices, shall be of such efficiency in watts per candle, when used on the utility's circuits of standard voltage as defined in rule 26, so that consumers may obtain their lighting service under the most favorable conditions practicable under the rate schedule.

WEST VIRGINIA.

RULE 20. Incandescent lighting.—(a) Every utility supplying electricity for incandescent lighting shall inspect in a general way the incandescent lamps of every consumer to whom free lamp renewals are supplied at least once every year, and render its consumers reasonable assistance in securing incandescent lamps and other appliances best adapted to the service furnished.

(b) Lamps furnished by utilities to consumers without charge, "free renewals," or at prices less than open-market prices, shall be of an efficiency in watts per candle equal to that of the standard tungsten incandescent lamp, when used on the utilities circuits of standard voltage as defined in rule 24 (p. 215), so that the cost of light per candlepower hour to consumers will not exceed the cost per candlepower hour when incandescent lamps are bought in the open market.

(c) Where unusual conditions prevail, every utility supplying electricity for incandescent lighting shall specifically inform each of its consumers as to the conditions under which efficient lighting service may be secured from its system.

INSTALLATION TESTS.

ARIZONA.

RULE 14. Each electric service meter shall be tested and adjusted for accuracy at the time of its first installation.

COLORADO.

RULE 36. Installation tests.—All service watt-hour meters shall be tested and, adjusted to register accurately to within the limits specified in rule 35, and to otherwise conform with the requirements of that rule, either before installation or within 60 days after installation. Each commutator meter and direct-current meter shall be tested and adjusted within 60 days after installation. Whenever possible all meters should be tested after being installed for service, at which time they should be checked for correct connection, suitable location, and proper mechanical condition.

CONNECTICUT.

RULE 4. Tests of meters before installation.—(a) Every meter installed after August 1, 1915, for measuring electrical energy to any customer, shall be in good order and adjusted by the utility to register within the limits prescribed in rule E-15 before or within 60 days after being placed in service.

(b) No utility shall, without the consent of the customer, install a prepayment meter adjusted to vend the service at a rate in excess of that charged to customers served through ordinary integrating meters.

RULE E-16. *Installation tests.*—(a) Each watthour meter shall be checked within 60 days after installation for correct connections, proper mechanical conditions, and suitability of location. In case of meters supplying primarily inductive circuits, a test shall also be made under conditions approximating as nearly as may be to heavy and light loads, as defined in rules E-14 and E-15.

DISTRICT OF COLUMBIA.

SECTION 5. *Installation tests and inspections.*—An installation test shall be made on all commutator-type meters.

An installation test or an installation inspection shall be made on all induction-type meters.

The period between the installation of a meter and the installation test or inspection should be long enough to allow the meter and the conditions around it to reach a fairly permanent state, but not long enough to permit a large registration.

ILLINOIS.

RULE 12. *Initial tests.*—Except as hereinafter provided, no watthour meter or demand meter shall be placed in service unless it has been tested and left in condition to meet the accuracy requirements of rule 10 (a). New meters or meters which have been repaired and tested in a factory or laboratory of recognized standing need not be tested by a utility before being put into service provided that they have been adjusted to meet the commission's requirements in the factory or laboratory prior to shipment.

RULE 13. *Installation meter tests.*—(a) Each meter shall be checked for correct connections, proper mechanical condition, and suitability of location in its permanent position in place of service at the time of installation or within 60 days thereafter.

(b) Each single phase watthour meter up to and including 25 amperes capacity shall be tested for accuracy of measurement in its place in service within 12 months after installation. All other watthour meters must be tested for accuracy of measurement in place of service within 60 days after installation. For the purpose of adjustment of bills the error found on any installation test shall be considered as having existed since the date of installation of the meter.

(c) Installation tests upon watthour meters which will be used on inductive loads shall be made under one of the following conditions: (1) By a test on the consumer's connected load under conditions approximating as closely as possible the heavy and light load requirements hereinbefore defined, or (2) by a test upon heavy and light noninductive loads, provided a shop adjustment to within 2 per cent of accuracy has been made prior to installation under conditions of full-rated current and 50 per cent lagging power factor

INDIANA.

RULE 14. *Installation tests of meters.*—(a) Each watthour meter shall be checked for correct connection, proper mechanical condition, suitability of location and accuracy of measurement in its permanent position in place of service at the time of installation or within 60 days after installation.

(b) Meters operating on inductive circuits shall be tested on the connected load under conditions approximating as nearly as may be to heavy and light loads, and shall be adjusted if necessary, so that the average error will not be more than 2 per cent.

(c) Meters installed with instrument transformers or shunts must be tested jointly with transformers or shunts; otherwise the ratio of transformation of the transformers or the calibration of the shunts must be determined at least once every 10 years.

MARYLAND.

See Accuracy requirements for watthour meters, and periodic tests of meters, pp. 56 and 163.

MICHIGAN.

28. *Installation tests.*—Each watthour meter shall be checked for correct connection, proper mechanical condition, suitable location, and good operating condition, in its permanent position in place of service, at the time of installation or within 30 days after installation.

29. Each watthour meter operating on a highly inductive circuit shall be tested in its permanent position at the time of installation, on the connected load under conditions approximating as nearly as possible to light and heavy loads, and be readjusted, if necessary, to bring the average error within the specified limits.

24. Tests for correct lagging shall be made before installation upon all alternating current service watthour meters which will or may be used on circuits supplying an inductive load, at 100 per cent of rated full-load current and 50 per cent lagging power factor, and adjusted so that the error is not more than 2 per cent.

MONTANA.

22. (c) Each watthour meter shall be checked by the utility for correct connection, proper mechanical condition, accuracy of measurement immediately before installation or within 60 days thereafter.

NEVADA.

RULE 16. Each electric service meter shall be tested and adjusted for accuracy at the time of its installation.

NEW HAMPSHIRE.

RULE 3. Each electric service meter shall be checked for correct connections, mechanical conditions, suitable location, and accuracy of measurement and shall be adjusted to within 1 per cent at light load and heavy load within 60 days after installation. Meters shall be tested under conditions similar to those at which they will be required to operate. Meters installed with instrument transformers or shunts must be tested jointly with the transformers or shunts, otherwise the ratio of transformation of transformers or calibration of the shunts must be determined at least once every five years, and records kept of such tests.

NEW JERSEY.

No. 22. Each electric meter shall be tested and adjusted for accuracy before installation or within 30 days after being set.

NEW YORK.

SECTION 7. Each watthour meter shall be tested and adjusted to register accurately within the limits specified in section 22 before installation or within 60 days after installation. Each direct-current meter shall be tested and adjusted within 60 days after installation.

Test reports of laboratory or installation tests need not be filed with the commission, and are not to be considered periodic, office, or complaint tests.

NORTH DAKOTA.

RULE 14. *Installation tests of meters.*—(a) Each watthour meter shall be checked for correct connection, proper mechanical condition, suitability of location and accuracy of measurement in its permanent position in place of service at the time of installation or within 60 days after installation.

(b) Meters operating on inductive circuits shall be tested on the connected load under conditions approximating as nearly as may be to heavy and light loads, and shall be adjusted, if necessary, so that the average error will not be more than 2 per cent.

(c) Meters installed with instrument transformers or shunts must be tested jointly with transformers or shunts; otherwise the ratio of transformation of the transformers or the calibration of the shunts must be determined at least once every 10 years.

OKLAHOMA.

RULE 16. *Installation tests.*—(a) All watthour and demand meters shall be tested and adjusted to register accurately to within the limits specified in rules 13 and 14 before installation, or within 60 days after installation; *Provided:* That all direct-current meters shall be tested and adjusted within 60 days after installation in their place of service.

(b) Watthour meters that are to be used on circuits of low-power factor (lagging current) shall be tested and adjusted before installation to register correctly to within 2 per cent, plus or minus, at a power factor of approximately 50 per cent, and at approximately 100 per cent of rated current.

OREGON.

RULE 21. *Installation tests.*—Each watthour meter shall be checked for correct connection, mechanical condition, suitable location, and if necessary shall be adjusted to be correct within 1 per cent at approximately three-quarters and one-tenth of the rated capacity of the meter by comparison of the meter in its permanent position in place of service with approved suitable standards at the time of installation or within 30 days thereafter.

PENNSYLVANIA.

NO. 14. *Test previous to installation.*—Each watthour meter installed after July 1, 1914, shall have been tested for accuracy by the utility within 90 days previous to its installation or shall be so tested within 60 days thereafter. It shall also be inspected by the utility for proper connection, mechanical condition, and suitability of location within 60 days after the installation.

WASHINGTON.

RULE 24. Each electric service meter shall be tested and adjusted for accuracy previous to its initial installation.

WEST VIRGINIA.

RULE 13. *Installation tests.*—Every direct current commutator-type watthour meter shall be checked within 30 days after installation for correct connections, mechanical condition, proper and suitable location, absence of creep, and accuracy of adjustment at light and heavy load.

WISCONSIN.

NO. 16. Each watthour meter shall be checked for correct connections, mechanical conditions, suitable location, and accuracy of measurement at approximately three-quarters and one-tenth connected load by comparing the meter with approved suitable standards in its permanent position in place of service within 30 days after installation. Meters operating at low-power factor shall also be tested at approximately the minimum power factor under which they will be required to operate. Meters installed with instrument transformers or shunts must be tested jointly with the transformers or shunts, otherwise the ratio of transformation of the transformers or calibration of the shunts must be determined at least once every five years.

INTERRUPTIONS OF SERVICE.³⁴

ARIZONA.

RULE 19. Each utility supplying electrical energy shall maintain a record of all interruptions of service upon the entire system or major divisions of its system, and include in such record, time, duration, and cause of each interruption.

COLORADO.

RULE 3. *Interruptions of service.*—(a) Each utility shall adopt an operating schedule, and shall report the same, or any changes therein, to this commission, indicating in any case where service is not rendered continuously, the time at which service is commenced, and the time at which it is discontinued. Any changes in such operating schedules shall be made only with the approval of this commission.

(b) Each utility shall keep a record of all interruptions of service upon its entire system or major divisions thereof, including a statement of the time, duration, and cause of any such interruption. Each utility shall, except for stations operated without attendants, also keep a record of the time of starting up or shutting down the central station or substation generating, transforming, or pumping equipment, and the period of operation of all regulators used for the maintenance of constant gas or water pressure, or constant voltage of electricity supplied. This record shall include the readings taken periodically of station meters and switchboard instruments, which readings shall be taken with such frequency as the utility or the commission may from time to time require.

(c) The record of interruptions of service and a statement of the operating schedules of the utility shall be open at all times to the inspection of the duly authorized representatives of this commission.

CONNECTICUT.

RULE 9. *Interruptions of service.*—(a) Each utility shall keep a record of all interruptions of service involving its entire system or major divisions thereof, including therein a statement as to time, duration, and cause of such interruption.

INDIANA.

RULE 25. *Interruptions of service.*—Each utility shall make all reasonable efforts to eliminate interruptions of service, and when such interruptions occur shall endeavor to reestablish service with the shortest possible delay. Whenever the service is interrupted for the purpose of working on the distribution system or the station equipment, this shall be done at a time which will cause the least inconvenience to consumers, and those most seriously affected by such interruption shall, if possible, be notified in advance.

ILLINOIS.

RULE 6. *Interruptions of service.*—(a) Each utility shall make all reasonable efforts to prevent interruptions of service. When interruptions occur the utility shall reestablish service with the shortest possible delay. The commission shall be notified at once if service is discontinued for a period of 24 hours or more in a community where limited service is furnished or for 12 hours or more in any other community.

Whenever the service must be interrupted for the purpose of working on the distribution system or the station equipment, this work shall be done at a time which will cause the least inconvenience to consumers and those who will be most seriously affected by such interruptions shall, so far as possible, be notified in advance.

³⁴ See also p. 198, "Station records."

(b) Each utility shall keep a separate record of all interruptions affecting service to the entire system, each community, and each important distribution circuit. This record shall show the time, date, duration, extent, and cause of the interruption.

For the purpose of this record an interruption is defined as a failure of any portion of the system or equipment whereby the voltage is reduced to less than 50 per cent of the standard voltage.

MARYLAND.

(c) Each utility shall keep a record of all interruptions to service upon its entire system, or larger divisions thereof, including a statement as to the time, duration, and cause of any such interruption. These records shall be open at all times to the inspection of an authorized representative of the commission.

MICHIGAN.

53. *Interruptions of service.*—Each utility shall make all reasonable efforts to prevent interruptions of service, and when such interruptions occur shall endeavor to reestablish service with the shortest possible delay. Whenever the service is necessarily interrupted or curtailed for the purpose of working on the distributing system or the station equipment, it shall be done at a time which will cause the least inconvenience to consumers, and those consumers which may be more or less seriously affected, shall be notified in advance.

MISSOURI.

RULE 6. Reasonable efforts shall be made to eliminate interruptions of service, and when such interruptions occur, service should be reestablished within the shortest possible delay. When service is interrupted for the purpose of working on any portion of the system, such interruption should occur at a time which will cause the least inconvenience to the consumer, and those seriously affected by such interruptions should, if possible, be notified in advance.

A record shall be kept of all interruptions of service on the entire system or major divisions thereof, including the time, duration, and cause of each interruption. These records shall be filed available for inspection by the commission and preserved for a period of at least one year.

MONTANA.

RULE 7. *Interruptions of service.*—(a) Each utility shall make all reasonable efforts to eliminate interruptions of service, and when such interruptions occur shall reestablish service with the shortest possible delay. Whenever the service is interrupted for the purpose of working on the distribution system or station equipment, this shall be done at a time which will cause the least inconvenience to consumers, and those most seriously affected by such interruption shall, if possible, be notified in advance.

(b) Any temporary failure of the utility to supply service by reason of accidents or otherwise, shall not render the utility liable beyond a prorata abatement of service charges during the interruption, provided that such prorata abatement shall not be made unless it shall amount to at least 1 per cent of the service charge.

NEVADA.

RULE 22. Each company supplying electrical energy shall maintain a record of all interruptions of service upon the entire system or major divisions of its system, and include in such record, time, duration, and cause of each interruption.

NEW HAMPSHIRE

(See "Station records.")

NEW JERSEY.

RULE 7. Each utility furnishing electric service shall keep a record of the time of starting and shutting down power-station equipment and feeders, together with the indications of the several switchboard instruments at frequent intervals and shall maintain a record of all interruptions of service upon the entire system or major divisions of its system, and include in such record time, duration, and cause of each interruption.

NORTH DAKOTA.

RULE 25. *Interruption of service.*—Each utility shall make all reasonable efforts to eliminate interruptions of service, and when such interruptions occur shall endeavor to reestablish service with the shortest possible delay. Whenever the service is interrupted for the purpose of working on the distribution system or the station equipment, this shall be done at a time which will cause the least inconvenience to consumers, and those most seriously affected by such interruption shall, if possible, be notified in advance.

OKLAHOMA.

RULE 32. *Record of interruptions to service.*—(a) Each utility shall make all reasonable efforts to prevent interruptions of service. When interruptions occur the utility shall reestablish service within the shortest possible delay. The commission shall be notified within 24 hours if service is discontinued for a period of 12 hours or more in a community where limited service is furnished or for 6 hours or more in any other community.

(b) Whenever the service must be interrupted for the purpose of working on a distribution system or the station equipment, this work shall be done at a time which will cause the least inconvenience to consumers, and those who will be most seriously affected by such interruptions shall, so far as possible, be notified in advance.

(c) Each utility shall keep a separate record of all interruptions affecting service to the entire system, each community, and each important distribution circuit. This record shall show the time, date, duration, extent, and cause of the interruption. These records shall be kept on file at least one year after the interruption occurs.

(d) For the purpose of this record an interruption is defined as a failure of any portion of the system or equipment whereby the voltage is reduced to less than 50 per cent of the standard voltage for a period of three minutes or longer.

OREGON.

RULE 9. Each utility shall keep a record of all interruptions of service upon its entire system or major divisions thereof, including therein a statement as to the time, duration, and cause of such interruptions. Such record shall be open at all times to public inspection, and the commission may at any time require from the utility a copy thereof.

PENNSYLVANIA.

No. 5. *Records of load and interruptions.*—Each utility shall keep a record of the time of starting and disconnecting all street-lighting circuits, of the readings of such instruments at each generating station and at such intervals as are necessary to determine the characteristics of the load, and of all interruption to service affecting the busbars, feeders, or distributing mains, which record shall show the time, duration, extent, and the cause, when known, of the interruption. An interruption is here defined, for purposes of record only, as the interval of time during which the voltage falls below 50 per cent of standard voltage. All such records shall be kept as specified in rule 10 for at least two years.

SOUTH CAROLINA.

RULE 7. *Interruption of service.*—Each utility shall keep a record of any interruption of service, affecting its busses, or any of its outgoing feeders or circuits, including a statement of the time, duration, and cause of any such interruption.

WASHINGTON.

RULE 10. Each company supplying gas, electric current, or water shall keep a record of all interruptions of service upon its entire system, or major divisions of its system, and include in such record the time, duration, and cause of such interruptions, and such records shall be open at all times to public inspection and the commission may at any time require from such company a copy of such record.

WISCONSIN.

RULE 23. *Interruption of service.*—Each electric utility shall make all reasonable efforts to eliminate interruptions of service, and when such interruptions occur shall endeavor to reestablish service with the shortest possible delay. Whenever the service is interrupted for the purpose of working on lines or equipment, this shall be done at a time which will cause the least inconvenience to consumers, and those most seriously affected by such interruptions shall, if possible, be notified in advance.

INSPECTION OF DISTRIBUTION SYSTEM AND APPARATUS.

COLORADO.

RULE 4. *Inspection of plant and equipment.*—Each utility shall inspect its plant and distributing equipment and facilities in such manner and with such frequency as is in accord with good practice, in order that the same may be maintained in proper condition for use in rendering safe and adequate service.

CONNECTICUT.

RULE E-4. *Periodic inspection of distribution system.*—(a) Each utility shall, semi-annually, during the spring and fall of each year, make a specific, comprehensive inspection of all its overhead plant, lines, devices, and appliances by means of which it conveys or transmits electrical energy.

(b) The person or persons making such inspection shall render a duplicate written and signed report thereof to the utility, describing the location and circumstances and containing explanatory details of each apparently dangerous condition found. A duplicate copy of such report shall be filed at the office of the commission within 10 days after such inspection. The utility shall also file at the office of the commission a statement showing the date and general character of its correction of any such dangerous condition so found and reported within 10 days after such correction, unless such correction is observed by and appears in the report of the inspector.

MARYLAND.

(d) Each utility shall inspect its plant and distributing equipment and facilities in such manner and with such frequency as is in accord with good practice, in order that the same may be maintained in proper condition for use in rendering safe and adequate service.

NEW JERSEY.

No. 12. Whenever any transformers, high-tension insulators, or other appliances are removed from the system for any reason they must be inspected before being reinstalled in the same or other location.

PENNSYLVANIA.

No. 8. *Defective apparatus.*—Whenever any equipment or facilities, the failure of which would involve life hazard, are removed from service for any reason they must be thoroughly inspected and tested before being again placed in service, and no equipment or facilities shall be placed in service or continued in service which have for any reason become dangerous or are liable to cause injury to persons or damage to property.

SOUTH CAROLINA.

RULE 6. *Inspection of plant and equipment.*—(a) Each utility shall maintain its plant, distribution system, and facilities at all times in proper condition for use in rendering safe, adequate, and continuous service.

(b) Each utility shall, upon request of the commission, file with the commission a statement regarding the condition and adequacy of its plant, equipment, facilities, and service in such form as the commission may require.

WEST VIRGINIA.

RULE 2. (b) Every utility shall make annual systematic inspection of its plant, equipment, and facilities during the month of May or June, keeping a record of the results of all such inspections, and shall file with the commission annually, not later than the 30th day of June, a statement of the condition of its plant, equipment, and facilities in such form as the commission may require.

MAINTENANCE AND CONSTRUCTION.

COLORADO.

RULE 27. *Accepted good practice.*—The generating and distributing system, including generating equipment, transmission lines, substations, overhead systems, poles, lines, transformers, underground system, manholes, conduits, etc., street-lighting systems, service wires and attachments, meters, and instruments, shall be constructed, installed, and maintained in accordance with accepted good practice.

CONNECTICUT.

RULE E-1. *Maintenance of plant, equipment, and facilities.*—(a) Each utility shall have and maintain its entire plant and system in such condition as will enable it to furnish safe, proper, and adequate service.

RULE E-2. *Distribution system.*—(a) The distribution system (including transmission lines, substations, overhead systems, poles, lines, transformers, etc.; underground system, manholes, conduits, etc.; street-lighting system; service wires and attachments; meters and instruments) must be constructed and maintained in accordance with accepted good practice. The commission will be inclined to quote the specifications and recommendations of the major organizations of electric utilities as accepted good practice.³⁵

RULE E-19. *Reconstruction not required.*—(a) The foregoing regulations, with the exception of Rule E-3 entire (referring to pole identification), shall not be construed to require general reconstruction or reequipping in order to conform with the rules for equipment or construction from time to time contained in the National Electrical Code, or in accordance with the other standards now adopted but not in force when such equipment was installed or construction made, but the commission reserves the right to deal with specific cases as the particular conditions may require.

³⁵ NOTE.—It is contemplated that rules and standards for joint use of poles will later be issued, pending which issue the recommendations heretofore made by the commission in docket No. 638, pertaining to joint use of poles, will remain in full force and effect.

MARYLAND.

1. Each utility shall maintain its equipment and transmission and distribution lines and appurtenances in an operating condition in conformity with good practice, and shall create and maintain such periodic inspection and maintenance as will reasonably insure continuous and good service within the hours of operation. A complete record shall be kept of all such inspection, which record shall clearly show the condition of all equipment and lines and appurtenances. The record shall be, at all times, subject to inspection by an authorized representative of the commission.

NEW JERSEY.

1. Each utility generating, transmitting, distributing, or selling electricity for light, heat, power, or other purposes, shall have and maintain its entire plant and system in such condition as will enable it to furnish safe, proper, and adequate service.

2. The construction of buildings, machinery, and generating plant of the utility must be in accordance with the requirements of the National Electrical Code of the edition of 1913.

3. The distribution system, including:

- (a) Transmission lines;
- (b) Substations;
- (c) Overhead system, poles, lines, transformers, etc.;
- (d) Underground system, manholes, conduits, etc.;
- (e) Street-lighting system;
- (f) Service wires and attachments;
- (g) Meters and instruments;

must be constructed in accordance with good standard practice. It is expected that all possible care will be exercised by each company to reduce the life hazard to which employees, customers, and others may be subjected by the presence of overhead wires in the public streets and ways. It is also expected that each company will so conduct its affairs as to cause the least possible danger or loss to other public utilities which make use of the streets and roads. *Standard practice for electrical construction work is indicated in various specifications, the names of some of which are given below. The specifications referred to are not to be considered part and parcel of the rules and regulations, but are to be considered as indicative of good standard practice.*³⁶

1st. Specifications covering methods of overhead line construction for 2,300-volt distribution and for street-lighting circuits, and specifications for material.

2nd. Specifications covering methods of overhead line construction for secondary voltages, including pole wiring for street-lighting work.

3rd. Specifications attached to "Inter-company agreement form and specifications for the joint use of poles by lighting and telephone companies."

4th. Specifications for overhead crossings of electric light and power lines.

Note.—Numbers 1, 2, 3, and 4 are set forth in the four sections of the "Report of Committee on Overhead Line Construction," approved by the National Electric Light Association, May 29 to June 2, 1911, and section 4 as approved by the committee representing the American Institute of Electrical Engineers, American Electric Railway Association, American Railway Engineering Association, the Association of Railway Telegraph Superintendents, and the American Railway Association.

5th. Report of the Committee on Power Distribution read before the American Electric Railway Association, October 13, 1913.

6th. Report of the Committee on Joint Use of Poles read before the American Electric Railway Association, October 13, 1913.

7th. National Electrical Code.

³⁶ Sections here printed in italics are underscored in the New Jersey rules, and are recommendations only.

By National Electrical Code is meant the code which is described as follows:

"The National Electrical Code was originally drawn in 1897 as the result of the united efforts of the various insurance, electrical, architectural, and allied interests, which through the National Conference on Standard Electrical Rules, composed of delegates from various national associations, unanimously voted to recommend to their respective associations for approval and adoption; and presented by the National Board of Fire Underwriters with the various amendments and additions which have been made since that time by them."

The National Conference has disbanded, the work of the Underwriters' National Electric Association and of the National Conference having been taken over by the National Fire Protective Association.

The following associations, formerly members of the National Conference, are represented on the Electrical Committee of the National Fire Protective Association:

- American Electric Railway Association.
- American Institute of Electrical Engineers.
- Association Factory Mutual Fire Insurance Cos.
- National Board of Fire Underwriters.
- National Electric Light Association.
- National Electrical Contractors' Association.
- National Electrical Inspectors' Association.

13. A utility may refuse to connect with any customer's wiring when it is not in accordance with the provisions of the National Electrical Code of 1913, or when the certificate of the underwriters or of the local inspection bureau has not been issued, or when the wiring is defective under the rules of the utility.

30. *The utility should have the right of access to customer's premises, and to all property furnished by the utility at all reasonable times, for the purpose of reading meters or inspecting or repairing appliances used in connection with the supply of service, or for the removal of its property at the time service is to be terminated. The customer should obtain, or cause to be obtained, all necessary permits needed by the utility in giving it access to the appliances referred to. The customer should not permit access to the meter and other appliances of the utility except by authorized employees of the utility or properly qualified State or local inspectors. In case of defective service, the customer should not interfere with the apparatus belonging to the utility, but should immediately notify the proper parties to have the defects remedied.*

31. The utility will not be held responsible for resulting inadequacy of service if customers make additions or alterations to the electrical equipment on their premises without first having notified the utility of their intention so to do, and the installation must comply with the rules of the utility furnishing the service.

32. Nothing herein contained shall require any utility to furnish service until the customer shall have conformed to the reasonable rules of the utility, not inconsistent with the foregoing regulations.

33. The foregoing regulations, with the exception of those referring to pole identification, shall not be construed to require reconstruction in accordance with rules for equipment or construction from time to time contained in the Electrical Code or other standards referred to, not in force when such equipment was installed or construction made, but the board reserves the right to deal with specific cases as the particular conditions require.

OKLAHOMA.

RULE 6. Maintenance of plant. Equipment and facilities.—(a) Each utility shall have and maintain its entire plant and system in such condition as will enable it to furnish safe, adequate, and continuous service within its hours of operation.

(b) Each utility shall file with the commission annually a statement regarding its plant, equipment, and facilities, in such form as the commission may require.

RULE 7. *Accepted good practice.*—The generating and distributing system, including:

- (a) Generating equipment;
- (b) Transmission lines;
- (c) Substations;
- (d) Overhead systems, poles, lines, transformers, etc.;
- (e) Underground systems, manholes, conduits, etc.;
- (f) Street-lighting system;
- (g) Service wires and attachments;
- (h) Meters and instruments;

shall be constructed, installed, maintained, and operated in accordance with accepted good practice.

Accepted good practice shall be defined by the rules governing construction, operation, and maintenance as found in the current editions of the National Electrical Safety Code and the National Electrical (Fire) Code.

RULE 34. *Filing of maps.*—Suitable maps and records shall be kept on file showing the location of each transmission line, primary and secondary circuit, substation and transformer being used in the production, transmission, and distribution of electrical energy. These maps shall be brought up to date once each year and the revised copies filed with the commission, on or before January 1 each year.

PENNSYLVANIA.

(See *Maintenance*, Pennsylvania, No. 7, p. 190.)

SOUTH CAROLINA.

RULE 25. *Extent of system on which utility must maintain service.*—Each electric utility, unless specifically relieved in any case by the commission from such obligation, shall operate and maintain in safe, efficient, and proper condition all the facilities and instrumentalities used in connection with the regulation, measurement, and delivery of electric current to any consumer up to and including the point of delivery into the wiring owned by the consumer.

RULE 26. *Maps.*—Suitable maps or records shall be kept on file showing the size, character, and location of each main, circuit, and feeder.

WEST VIRGINIA.

RULE 2. *Maintenance of plant.*—(a) Every utility generating, transmitting, distributing, or selling electricity for light, heat, power, or other purposes shall have and maintain its entire plant and system in such condition as will enable it to furnish safe, proper, and adequate service.

RULE 3. *Plant to be in accordance with National Electrical Code.*—The construction of buildings, machinery, and generating plant of the utility shall be in accordance with the requirements of the current edition of National Electrical Code, as far as feasible.

RULE 4. *Standard practice.*—The distribution system, including:

- (a) Transmission lines;
- (b) Substations;
- (c) Overhead system poles, lines, transformers, etc.;
- (d) Underground system, manholes, conduits, etc.;
- (e) Street-lighting system;
- (f) Service wires and attachments;
- (g) Meters and instruments;

must be constructed and maintained in accordance with good standard practice.

METER LOCATION.**COLORADO.**

RULE 33. *Locations of meters.*—(a) It is recommended that all meters hereafter installed on consumers' premises should be located in the cellar or on the first floor or as nearly as possible at the point of entrance of service to the premises, in a clean, dry, safe place not subject to great variations in temperature, and on a support free from vibration. When it is necessary to install meters out of doors they should be suitably protected from the elements and other sources of damage.

(b) Meters should not be placed in coal or wood bins or on the partitions forming such bins, nor on any unstable partitions or supports. Unless unavoidable, meters should not be installed in attics, sitting rooms, bathrooms, bedrooms, restaurant kitchens, over doors, windows, or in any location where the visits of the meter reader or tester will cause annoyance to or inconvenience the consumers.

(c) Meter locations should be such that they are easily accessible for reading, testing, and making necessary adjustments and repairs. When a number of meters are placed on the same meter board the distance between centers should not be less than 15 inches, and each meter loop should be so tagged or marked as to indicate the circuit metered. Meters should preferably be not less than 4 feet nor more than 7 feet above the floor or a suitable platform.

CONNECTICUT.

RULE E-11. *Location of service meters.*—(a) It is recommended that all meters hereafter installed on customers' premises shall be located in the cellar or first floor, as near as possible to point of entrance of the service, in a clean, dry, safe place not subject to great variations in temperature and on a support as free as possible from vibration. The meter must be accessible for reading and testing.

(b) Meters should not be placed in coal or wood bins or on the partitions forming the same, nor on any unstable partitions or supports. Unless absolutely unavoidable meters should not be installed in attics, sitting rooms, bathrooms, bedrooms, restaurant kitchens, over doors, over windows, or in any location where the visits of the meter reader or tester will cause annoyance to the customer.

DISTRICT OF COLUMBIA.

SECTION 1. *Location of meters.*—A meter should be so located as to be as near as possible to the point where the service enters the building, to be accessible with a minimum of annoyance to the tenants, to be easily read, to be surrounded by sufficient space to permit the tester to arrange and use his testing apparatus and to make the necessary inspection and adjustments. A meter should be installed on a stable support, in a clean, dry, safe place, free from vibration and not subject to great variation in temperature.

When two or more meters are installed, the distance between centers of commutator type direct-current meters shall not be less than 15 inches, and the distance between centers of mercury type direct-current or induction type alternating-current meters shall not be less than 12 inches.

ILLINOIS.

RULE 7. *Location of meters.*—It is recommended that all meters hereafter installed on consumers' premises be located in the basement or on the first floor as near as possible to the service entrance, in a clean, dry, safe place, not subject to wide variation in temperature and on a support free from vibration.

Unless unavoidable, no meter hereafter installed shall be placed in coal or wood bins or on the partitions forming such bins or on any unstable partitions or supports, or in any location where its accuracy may be affected by exposure to the elements. Unless unavoidable, meters shall not be installed in attics, sitting rooms, bathrooms, bedrooms, restaurant kitchens, over doors, over windows, or in any location where the visits of the meter reader or tester will cause annoyance to the consumer.

INDIANA.

RULE 10. Location of meters.—(a) It is recommended that all meters hereafter installed on consumers' premises should be located in the cellar or first floor, or as near as possible to the service, in a clean, dry, safe place, not subject to great variations in temperature and on a support free from vibration. Where it is necessary to install meters out of doors, they should be protected from the weather.

(b) Meters should not be placed in coal or wood bins or on the partitions forming such bins nor on any unstable partitions or supports. Unless unavoidable, meters should not be installed in attics, sitting rooms, bathrooms, bedrooms, restaurant kitchens, over doors, over windows, or in any location where the visits of the meter reader or tester will cause annoyance to the consumer or utility.

(c) Meters should be easily accessible for reading, testing, and making necessary adjustments and repairs. When a number of meters are placed on the same meter board, the distance between centers should not be less than 15 inches, and each meter loop should be so tagged or marked as to indicate the circuit metered. Meters should preferably not be less than 4 feet, nor more than 7 feet, above the floor or a suitable platform.

MARYLAND.⁸⁷

Meters.—All meters must be installed in cellars or first floor, unless the particular conditions of the case do not permit it, and except in such cases as the following:

1. Buildings which were wired prior to the issuance of these rules and have meter loops left in other locations.

2. Office buildings and apartment houses; if separate meters are required for each office or apartment, the building should be wired for all meters to be located at a common point in the cellar. Each of these meter locations must be plainly marked in a legible manner to indicate the office or apartment served by it.

3. Buildings in which the various floors are rented separately, but in which there is no common cellar or hallway accessible to all tenants, then the meter must be installed on that particular floor to which the current is supplied.

4. Under no circumstances will the installation of meters be permitted in bathrooms, bedrooms, closets, over doors, or in inaccessible locations. Meters will also not be permitted on partitions or other supports liable to excessive vibration or in locations subject to excessive moisture or extremes of temperature.

5. Meters must be located as near the point of service entrance as possible and not over 7 feet nor less than 4 feet from the floor.

MICHIGAN.

11. Location of meters.—In general, it is recommended that all meters installed on consumers' premises be located in the basement or first floor as near as possible to the service entrance, in a clean, dry place, secure from injury and not subject to vibration or great variation in temperature. Where it is desired to install meters out of doors, they should be installed on a rear or side porch in a weather-proof cabinet with door hinged at the side.

⁸⁷ Order No. 1378. Public Service Com. of Maryland. This order is applicable only to the Consolidated Gas, Electric Light & Power Co., of Baltimore.

12. Meters should not be placed in basements where the only entrance is through a trap door, or on porches facing the street, or on lattice or metal lath partitions. Meters should not be placed in coal or wood bins or on the partitions of such bins, or in sheds, attics, bedrooms, bathrooms, toilet rooms, restaurant kitchens, stairways, or ventilating shafts, or in any place where the visits of the meter reader will cause inconvenience either to the consumer or the meter reader. Meters should not be placed over windows, doors, stoves, sinks, tubs, or in any place subject to flyings or excessive moisture or other fumes. Where it is necessary to install them in places subject to flyings, moisture, or fumes they should be protected by a dust-proof cabinet. Meters should not be placed in the neighborhood of gas, steam, water, or other piping, or near belts and moving machinery. They should be placed at least 10 feet and, if possible, 15 feet from any electric machinery and at least 18 inches from any conductors carrying a current exceeding 100 amperes.

13. In cases where it is necessary to recess a meter in the wall, a cabinet shall be provided, the walls and doors of which must be made of some fireproof material. If metal is used in such cases, or, moreover, in any other cases, it must be covered with some form of insulation so as to prevent the possibility of a short circuit when connecting, disconnecting, or testing meters.

14. Meters should be easily accessible for reading, testing, and adjusting, and should be placed not higher than 7 feet above the floor, nor lower than 4 feet unless protected. When more than one meter is placed on the same meter board the distance between them should be not less than 8 inches, and a separate cut-out and switch should be installed for each meter.

MISSOURI.

RULE 4. Each service meter shall be suited to the particular installation to which it is assigned and chosen with a view of obtaining the best adaptation to local conditions and to the load.

MONTANA.

RULE 21. *Location of meters.*—(a) It is recommended that all meters hereafter installed on consumers' premises shall be located in the cellar or first floor, or as near as possible to the service in a clean, dry, safe place, not subject to great variations in temperature, and on a support free from vibration. Where it is convenient to install meters out of doors, they should be protected from the weather.

(b) Meters shall not hereafter be placed in coal or wood bins or on the partition forming such bins nor on any unstable partition or supports. Meters installed hereafter must be located at not less than 4 nor more than 7 feet above the floor and, unless unavoidable, shall not be installed in attics, dark closets, bathrooms, bedrooms, over stoves, sinks, or other plumbing fixtures, or in any location where the visits of the meter reader or tester will cause annoyance to the consumer or utility.

(c) In store buildings meters must not hereafter be located where they may be covered with merchandise, or where shelving will not permit the ready removal of the meter cover.

(d) Meters must be located in places accessible at all reasonable hours for reading, testing, and making of necessary repairs and adjustments. In office buildings, flats, or apartment houses, meters must not be located in the individual offices, flats, or apartments, but should be grouped in meter cabinets in hallways, basements, or on outside of buildings. When a number of meters are placed on the same board, a minimum spacing of 15 inches in any direction between centers of meters should be provided, and each meter loop shall be tagged or marked so as to indicate the circuit metered. Where meters are grouped, the main line fuse and switch box, if one is required, and the individual meters must be joined by continuous conduit, and one or more fuse blocks, depending upon the capacity of the installation, must be installed between the meter and the consumers' load.

(e) In restaurant kitchens, mills, and foundries, a box or cabinet must be provided by the consumer to completely inclose the meter. A utility may furnish and install a meter connection box on any service.

(f) The installation of meters and connections shall be strictly in accordance with the rules of the National Electrical Code, and the utility rendering the service.

(g) Final connection with the meter shall in all cases be made by the utility and shall not be altered or tampered with except by representatives of the utility.

NEW JERSEY.

16.³⁸ *All meters hereafter placed in buildings should be located in the cellar or first floor as near as possible to the point of entrance of the service in a clean, dry, safe place, free from vibration, not subject to great variation in temperature, and the top of the meter board should not be more than 6 feet nor the bottom less than 4 feet above the floor, or above a suitable platform underneath the meter, where it shall be easily accessible for reading and testing.*

Under no circumstances should meters be placed in coal or wood bins or on the partitions forming the same, nor any flimsy partitions or supports.

In cases where buildings have no cellar, or have very damp cellars or cellars that are not easily accessible, the meter should be installed on the first floor.

Unless absolutely unavoidable meters should not be installed in attics, sitting rooms, bathrooms, bedrooms, restaurant kitchens, over doors, over windows, or any location where the visits of the meter reader or tester will cause annoyance to the customer.

The installation of meters and connections shall be strictly in accordance with the rules of the National Electrical Code of 1913 and the utility furnishing the service.

NEW YORK.

1. Meters shall be installed in a clean, dry, safe place, not subject to vibration or great variations in temperature.

2. Where it is necessary to install meters in locations exposed to weather conditions, they shall be protected by suitable boxes or cabinets.

3. Meters should be easily accessible for reading, testing, and making necessary adjustments and repairs.

NORTH DAKOTA.

RULE 10. Location of meters.—(a) It is recommended that all meters hereafter installed on consumers' premises should be located in the cellar or first floor, or as near as possible to the service, in a clean, dry, safe place, not subject to great variations in temperature and on a support free from vibration.

Where it is necessary to install meters out of doors, they should be protected from the weather.

(b) Meters should not be placed in coal or wood bins or on the partitions forming such bins nor on any unstable partitions or supports. Unless unavoidable, meters should not be installed in attics, sitting rooms, bathrooms, bedrooms, restaurant kitchens, over doors, over windows, or in any location where the visits of the meter reader or tester will cause annoyance to the consumer or utility.

(c) Meters should be easily accessible for reading, testing, and making necessary adjustments and repairs. When a number of meters are placed on the same meter board, the distance between centers should not be less than 15 inches, and each meter-loop should be so tagged or marked as to indicate the circuit metered. Meters should preferably not be less than 4 feet, nor more than 7 feet, above the floor or a suitable platform.

³⁸ Where such text is underlined [here in *italics*], the part so underlined should be regarded as the recommendation of this board for the guidance of the utilities to whom said recommendations are applicable, which recommendations should in the opinion of the board, be observed and followed by such utilities.

OKLAHOMA.

RULE 11. Location of meters.—(a) It is recommended that all meters hereafter installed on consumers' premises be located in the cellar of first floor, or as near as possible to the service, in a clean, dry, safe place, not subject to wide variations in temperature and on a support free from vibration, such support to be provided by the consumer. Where it is necessary to install meters out of doors, they should be protected from the weather.

(b) Unless unavoidable, no meter hereafter installed shall be placed in coal or wood bins or on the partitions forming such bins or on any unstable partitions or supports, or in any location where its accuracy may be affected by exposure to the elements. Unless unavoidable, meters shall not be installed in attics, sitting rooms, bathrooms, bedrooms, restaurant kitchens, over doors, over windows, or in any location where the visits of the meter reader or tester will cause annoyance to the consumer. There shall be no objection to the installation of meters on porches or out of doors if necessary means are employed to properly protect such meters.

(c) Meters should be easily accessible for reading, testing, and making necessary adjustments and repairs. When a number of meters are placed on the same meter board, the distance between centers should not be less than 12 inches, and each meter loop should be so tagged or marked as to indicate the circuit metered. Meters should preferably be not less than 4 feet, nor more than 7 feet, above the floor or a suitable platform.

SOUTH CAROLINA.

RULE 12. Location.—(a) No consumer's meter shall be installed in any location where it may be unreasonably exposed to heat, cold, dampness, or other cause of damage, or in any unduly, dirty, or inaccessible location.

(b) Meters should not be placed in coal or wood bins or on partitions forming such bins, or on any unstable supports subject to vibration.

(c) Meters should be easily accessible for reading, testing, and making necessary adjustments and repairs. When several meters are placed on one meter board the distance between centers should not be less than 15 inches, and each "house" loop should be tagged or marked to indicate the circuit metered.

(d) Each customer shall provide a suitable and convenient place for the location of meters, where they will be readily accessible at any reasonable hour for the purpose of reading, testing, repairing, etc., and such other appliances owned by the utility and placed on the premises of the consumer shall be so placed as to be readily accessible at such times as are necessary, and the authorized agent of the utility shall have authority to visit such meters and appurtenances at such times as are necessary in the conduct of the business of the utility.

WEST VIRGINIA.

RULE 9. Location of meters.—(a) It is recommended that all meters hereafter installed in consumers' residence shall be located in the cellar, first floor, porch, or other accessible place, as near as possible to the point of entrance of the service in a clean, dry, safe place, as free as possible from vibration and permitting of reading or testing.

(b) The meter should be easily accessible for reading, testing, and making necessary adjustments and repairs. When a number of meters are placed on the same board each meter should be tagged so as to indicate the circuit metered by it.

All direct current commutator-type meters shall be placed at least 15 inches apart.

(c) Meters should not be placed in coal or wood bins or on the partitions forming same, nor on any unstable partitions or supports. Unless absolutely unavoidable, meters should not be installed in attics, sitting rooms, bathrooms, bedrooms, restaurant kitchens, over doors, over windows, or in any locations where the visits of the meter readers or tester will cause annoyance to the consumer.

(d) Districts subject to flood are excepted from this rule so far as it applies to location of meters.

METER READINGS ON BILLS.**ARIZONA.**

RULE 23. Each utility shall render bills periodically, designating the reading of meters at the beginning and end of the time for which the bills are rendered and giving the dates at which the readings were taken. The bills shall also show the gross amount charged and net amount after deducting any rebates allowed for prompt payment.

COLORADO.

RULE 10. Meter readings and bill forms.—(a) Each service meter shall indicate clearly the cubic feet, kilowatthours, gallons, or other units of service for which charge is made to the consumer. In cases where the dial reading of a meter must be multiplied by a constant to obtain the units consumed, the proper constant to be applied shall be clearly marked on the face or dial of the meter.

(c) All bills rendered periodically to consumers for metered service furnished shall show, in addition to the net amount due, the dates on which the readings were taken, the meter readings at the beginning and end of the period for which the bill is rendered, when requested by the consumer or deemed necessary by the utility, and all other essential facts upon which the bill is based.

CONNECTICUT.

RULE 7. Meter dials, form of bills.—(a) Every meter shall indicate clearly the unit of service for which charge is made to the customer. The dial constant, if other than unity, shall be clearly marked on an exposed part of the meter.

(b) Each utility shall include upon all periodically rendered bills the dates of the beginning and end of the period during which the service was rendered and such other information as will, in conjunction with the published rates of the utility, make possible a convenient recomputation of the charges assessed.

(c) Any utility shall upon request supply to a customer a copy of such utility's rates applicable to the type or types of service furnished such customer. Any utility shall upon request supply to a customer a statement of the past readings of such customer's meter for any period not necessarily in excess of 15 months.

(d) Any utility shall upon the written request of a customer served through a prepayment meter cause the meter reader to leave with such customer at the time of reading the meter a slip showing its reading and the amount of money collected from it.

DISTRICT OF COLUMBIA.

SEC. 14. If the dial of a watthour meter does not read directly in kilowatthours, the dial constant shall be clearly indicated on the meter where it can be seen without disturbing any part of the meter.

All bills rendered periodically for service by an electrical corporation shall show on the face thereof the number and kind of units of service supplied, the dates on which the readings were taken, the price per unit of service, and a statement in bold type that the readings of the meter will be furnished on bills upon request. On all bills which are computed on any other basis than a definite charge per unit of service the other factors used in computing the bills shall be clearly stated so that the amount may be readily checked from the information appearing on the bills.

ILLINOIS.

RULE 6. Bills rendered periodically to consumers for metered service shall show the readings of the meter at the beginning and end of the period for which the bill is rendered, the energy used and the rate per kilowatthour. On all bills which are

computed on any other basis than a definite charge per kilowatthour the other factors used in computing the bill shall be clearly stated so that the amount may be readily computed from the information appearing upon the bill.

INDIANA.

RULE 18. Meter readings on bills.—Bills rendered periodically to consumers for metered service shall show the readings of the meter at the beginning and end of the period for which the bill is rendered, the number and kinds of units of service supplied, the dates of the meter readings, and the price per unit of service. On all bills which are computed on any other basis than a definite charge per unit of service, the other factors used in computing the bill shall be clearly stated so that the amount may be readily computed from the information appearing on the bill.

MARYLAND.

K1. The register of each service meter shall read in the same unit as that upon which the rate for service is based; and if not reading directly, the constant shall be plainly marked on the face of the dial.

2. Bills rendered to consumers for metered service shall show the readings of the meter for the beginning and ending of the period for which the bill is rendered, the number of units supplied, the dates of the meter readings and the price per unit.

MICHIGAN.

37. Information on bills.—Bills rendered periodically to consumers for metered service shall show the readings of the meter at the beginning and end of each period for which the bill is rendered, the number and kinds of units, nature of service supplied, dates of meter readings and price per unit. On all bills which are computed on any other basis than a definite charge per unit of service, the other factors used in computing the bill shall be clearly stated so that the amount may be readily computed and checked from the information appearing on the bill.

MISSOURI.

RULE 9. All bills rendered to consumers for metered service furnished shall show the reading of the meter at beginning and end of period for which bill is rendered and shall give dates of readings, number of units of service supplied, and the basis of charge or reference thereto. In general, these bills shall be made out in such a manner as to be readily understood by the consumer and so that the amount of the bill can be checked from the information appearing upon the bill.

This rule may be waived for any consumer by special written consent of such consumer.

MONTANA.

RULE 16. Bills.—Bills shall be rendered at regular intervals to consumers for metered service and shall show the readings of the meter at the beginning and end of the period for which the bill is rendered, the number and kinds of units of service supplied, the dates of the meter readings and the price per unit of service. On all bills which are computed on any other basis than a definite charge per unit of service, the other factors used in computing the bill shall be clearly stated so that the amount may be readily calculated from the information appearing on the bill.

RULE 20. Meter dials.—Each service meter shall be suited to the particular installation to which it is assigned and chosen with a view of obtaining the best adaptation to local conditions and to the load. Each meter shall indicate clearly the unit of service for which charge is made to the consumer. The meter constant, if other than unity, shall be clearly marked on an exposed part of the meter.

NORTH DAKOTA.

RULE 18. Meter reading on bills.—Bills rendered periodically to consumers for metered service shall show the readings of the meter at the beginning and end of the period for which the bill is rendered, the number and kinds of units and of service supplied, the dates of the meter readings and the price per unit of service. On all bills which are computed on any other basis than a definite charge per unit of service, the other factors used in computing the bill shall be clearly stated so that the amount may readily be computed from the information appearing on the bill.

NEVADA.

RULE 25. Bills shall be rendered monthly by the electric company and shall designate the readings of the meter at the beginning and end of the time for which the bill is rendered, the amount used during the month, and the dates at which readings were taken.

NEW HAMPSHIRE.

RULE 12. Bills rendered periodically for metered electric service shall designate the reading of the meter at the beginning and end of the interval for which the bill is rendered and shall give the dates on which the readings were taken and other data necessary to enable the customer conveniently to check the bill.

NEW JERSEY.

RULE 27. Meter dials should read directly in kilowatthours. If not, the dial constant must be clearly indicated where it can be seen without disturbing the case of the meter or the connections. Bills rendered periodically by the utility shall designate the readings of the meter at the beginning and end of the time for which the bill is rendered and give the dates on which the readings were taken. Bills shall also show the gross amount charged and the net amount after deducting the rebate, if any, allowed for prompt payment.

When prepayment meters are in use, the meter reader at the time of reading same shall leave with the customer a slip showing the readings as well as the amount of money collected from the meter.

OREGON.

RULE 7. Meter readings and bill forms.—(a) Every meter shall indicate clearly the cubic feet, kilowatthours, gallons, or other units of service for which charge is made to the customer. In cases where the dial reading on a meter must be multiplied by a constant to obtain the units consumed, the proper constant to be applied shall be clearly and plainly marked on the meter.

(b) Bills rendered customers by utilities shall show the readings of the meters at the beginning and end of the period of time for which rendered, the number and kinds of units of service supplied, and the price per unit, and on all bills computed on demand or connected load basis, the amount of connected load, maximum demand, or other factors used in computing the bill, shall be clearly stated, and all bills shall be made out in such a way that the amount may be readily recomputed from the information appearing plainly upon the face of the bill.

SOUTH CAROLINA.

RULE 11. Meter readings and bill forms.—(a) Bills shall be rendered for metered service periodically, and shall show the readings of the meter at the beginning and end of the period for which the bill is rendered, the number and kinds of units of service supplied, the dates of the meter readings, and the price per unit of service.

On all bills which are computed on any other basis than a definite charge per unit of service, the other factors used in computing the bill shall be clearly stated so that the amount may be readily computed from the information appearing on the bill.

Each bill subject to discount for prompt payment shall bear upon its face the date when the bill was mailed, or left at the premises of the consumer, or the latest date on which it may be paid without loss of discount or incurring of penalty.

WASHINGTON.

No. 8. All bills rendered to consumers by any company for gas, electric current, or water shall show the reading of the consumer's meter at the beginning and end of the period of time for which the bill is rendered and shall give the dates at which readings were taken, the number of units of service supplied, and the price per unit; and said bills shall be made out in such a way as to be readily understood by the consumer.

WEST VIRGINIA.

RULE 19. *Meter readings on bills.*—Bills rendered periodically by every utility supplying metered service shall show the readings of the meter at the beginning and end of the time for which bill is rendered, the dates on which the readings were taken, the number of kilowatthours supplied, and the price per unit. Where prepayment meters are in use, the meter reader at the time of reading same shall, upon request, leave with the consumer a statement of such form as prescribed by the public service commission, showing the readings as well as the amount of money collected from the meter.

WISCONSIN.

RULE 22. Bills rendered periodically for metered electric service shall designate the reading of the meter at the beginning and end of the interval for which the bill is rendered and shall give the dates of the readings of the meter.

METER-TESTING EQUIPMENT.

ARIZONA.

RULE No. 11. Each utility supplying electrical energy shall provide itself with suitable equipment for the testing of meters, and shall employ such methods as are prescribed by law or by any order of the Arizona Corporation Commission.

COLORADO.

RULE 34. *Meter testing facilities and equipment.*—(a) Each utility furnishing metered electric service shall, unless specifically excused by the commission, provide such meter laboratory, standard meters, instruments, and other equipment, and facilities as may be necessary to make the tests required by these rules. Such equipment and facilities shall be acceptable to the commission, and shall be available at all reasonable times for the inspection of its authorized representatives.

(b) (1) Each utility furnishing metered electric service shall provide such portable indicating electrical-testing instruments or watthour meters of suitable range and type for testing service watthour meters, switchboard instruments, recording voltmeters, and other electrical instruments in use, as may be deemed necessary and satisfactory by the commission.

(2) For testing the accuracy of portable watthour meters, commonly called "rotating standards," and other portable instruments used for testing service meters, each utility not specifically excused by the commission, as provided for in (a) of this rule, shall provide as reference or check standards suitable indicating electrical instruments, wattmeters, watthour meters, or any or all of them hereafter called "reference standards." Such reference standards may be of the service type of

watthour meters, but, if so, such watthour meters shall be permanently mounted in the meter laboratory of the utility and be used for no other purpose than for checking rotating standards.

Reference standards of all kinds shall be submitted at least once each year to the Standardizing Laboratory of the University of Colorado, or to some laboratory of recognized standing, for the purpose of test and adjustment. Utilities maintaining standardizing laboratories will be permitted to make their own tests and certifications of reference standards, provided the instruments and methods in use are acceptable to the commission.

(3) All portable watthour meters (rotating standards) shall be compared with the reference standards at least once a week for commutator types, and once in two weeks for induction types, during the time such portable standards are being regularly used. Unless accompanied by a calibration card, if such check shows any portable watthour meter to be in error more than 1 per cent plus or minus at any load at which the standard will be used, the meter shall be tested, adjusted, and certified in the Standardizing Laboratory of the University of Colorado or at some standardizing laboratory of recognized standing. Each portable watthour meter (rotating standard) shall at all times be accompanied by a certificate or calibration card signed by the proper authority, giving the date when it was last certified and adjusted. Records of certifications and calibrations shall be kept on file in the office of the utility.

(4) All portable indicating electrical testing instruments, such as voltmeters, ammeters, and wattmeters, when in regular use for testing purposes, shall be checked against suitable reference standards at least once a week when continually in use, and if found appreciably in error at zero, or more than 1 per cent of full-scale value at commonly used scale deflections, shall, unless accompanied by a calibration card, be adjusted and certified in some laboratory of recognized standing.

RULE 5. (b) Each utility shall make such tests as are prescribed under these rules with such frequency and in such manner and at such places as may be approved by this commission.

CONNECTICUT.

RULE 2. *Facilities for testing.*—(a) All tests made by any utility under these rules shall be performed according to such methods and at such places as may be approved by the commission, and the apparatus, equipment, and rooms used for such tests shall be at all reasonable times available for inspection by or the use of any member of or authorized representative of the commission.

RULE E-12. *Meter testing facilities and equipment.*—(a) Each utility furnishing metered electric service shall provide for and have available portable indicating electrical testing instruments and portable watthour meters of suitable range and type for testing its service watthour meters, switchboard instruments, recording voltmeters, and other electrical instruments in use as may be deemed necessary and approved by the commission.

(b) All portable rotating standards shall be compared with reference standards at least once a week for commutator types and once in two weeks for induction types during the time such portable rotating standards are being regularly used. If such check shows any rotating standard to have at any reasonable load an error in excess of 2 per cent, said rotating standard before being used shall be readjusted and certified in some laboratory approved by the commission. Each portable rotating standard shall at all times be accompanied by a certificate giving date when it was last certified, the corrections to be applied at various loads, and signed by the proper authority. These certificates, when superseded, shall be kept on file in the office of the utility.

(c) All portable indicating electrical testing instruments, such as voltmeters, ammeters, and wattmeters, when in regular use for testing purposes, shall be checked against reference standards at least once a week when continually in use, and if found

appreciably in error at zero or more than 1 per cent at commonly used scale deflection, shall be adjusted and certified in some laboratory approved by the commission before again being used.

(d) Whenever any utility is maintaining or shall hereafter establish a standardizing laboratory, inspection by the commission will be made of the instruments and methods employed, and if such instruments and methods are approved by the commission after such inspection, certification of portable and reference standards may be made by such laboratory.

DISTRICT OF COLUMBIA.

SECTION 3. *Apparatus.*—Each electrical corporation shall provide and maintain suitable apparatus and facilities for testing the accuracy of meters.

SECTION 4. All working standards shall be tested for accuracy as often as is necessary to insure their maintenance in proper condition for testing meters. If not checked in the laboratory of the electrical corporation, working standards shall be tested in a properly equipped laboratory of recognized standing. Each working standard shall at all times be accompanied by a certificate giving date on which it was last checked and the corrections to be applied to various loads, signed by the proper authority. The certificates, when superseded, shall be kept on file in the office of the electrical corporation.

ILLINOIS.

RULE 8. *Testing facilities and equipment.*—(a) Each utility shall provide for and have available such meter laboratory, standard meters, instruments, and other facilities and equipment as may be necessary to make the tests required by these rules.

(b) Each utility shall provide for and have available for use as working standards portable instruments of suitable range and type for testing consumers' watthour meters and demand meters.

(c) For testing the accuracy of portable watthour meters, commonly called "rotating standards," and other working standards used for testing consumers' meters, each utility shall provide or have available suitable indicating instruments or watthour meters, hereinafter called reference standards. For utilities having less than 500 meters in service such reference standard may be of the service type of watthour meter, but, if so, such watthour meter shall be permanently mounted in a place as free as possible from vibration and other disturbing influences and shall be used for no other purpose than for checking working standards.

All reference standards shall be checked at least once a year against instruments of known accuracy either in the possession of the utility or located in some laboratory of recognized standing.

(d) During times when the portable watthour meters (rotating standards) are regularly used for testing consumers' meters, they shall be compared with reference standards at least once each week if of the commutator or mercury types, or at least once each two weeks if of the induction type.

Where a utility having 500 or more watthour meters in service maintains a central meter department and it is not practicable to make comparisons with the reference standards with the frequency herein required, the utility may make use of the service type of watthour meter for checking working standards in the district where the tests are being made, provided comparisons are made at least once a month with the approved reference standards of the central testing station.

If such a comparison indicates that the portable watthour meter is in error by more than 1 per cent on any combination on which it will be used the meter shall be adjusted if possible to reduce the inaccuracy. In any case the correction indicated by the certificate or calibration card accompanying the instrument (see rule 8g) shall be applied.

(e) All working standards of the indicating type, such as voltmeters, ammeters, and wattmeters, when in regular use for testing meters, shall be compared against

suitable reference standards at least once a week. If found appreciably in error at the zero reading, or if found in error by more than 1 per cent at commonly used scale deflections, the instrument shall either be adjusted to read within the specified limits, or the proper correction factor shall be applied.

(f) Switchboard voltmeters which indicate voltage on transmission or distribution lines, ammeters used to measure station output or to determine phase balance, watt-hour meters used to record station output, and working standards used for purposes other than the testing of meters shall be checked at least once a year against instruments of known accuracy.

(g) Each working or reference standard shall be at all times accompanied by a certificate or calibration card, giving the date and results of the last calibration of the instrument and signed by the person responsible for the calibration. Such certificates or calibration cards, when superseded, shall be kept on file in the office of the utility.

INDIANA.

RULE II. Meter testing equipment and facilities.—(a) *Standardizing laboratory.* Whenever any utility is maintaining or shall hereafter establish and maintain a standardizing laboratory, periodic inspection by the commission will be made of the instruments and methods in use, and if instruments and methods are acceptable to the commission after such inspection, certification of meters and instruments for its own use and for other utilities may be made by such laboratory.

(b) *Equipment and facilities.*—Each utility furnishing metered electric service shall, unless specifically excused by the commission, provide for and have available such meter laboratory, standard meters, instruments, and other equipment, and facilities as may be necessary to make the tests required by these rules. Such equipment and facilities shall be acceptable to the commission, and shall be available at all reasonable times for the inspection of any authorized representative of the commission.

(c) *Test standards.*—1. Each utility furnishing metered electric service shall provide for and have available such portable indicating electrical testing instruments or watt-hour meters of suitable range and type for testing service watt-hour meters, switchboard instruments, recording voltmeters, and other electrical instruments in use as may be deemed necessary and satisfactory by the commission.

2. For testing the accuracy of portable watt-hour meters, commonly called "rotating standards," and other portable instruments used for testing service meters, each utility, not specifically excused by the commission as provided for in section (b) of this rule, shall provide for and have available as reference or check standards suitable indicating electrical instruments, wattmeters, watt-hour meters, or any or all of them, hereafter called reference standards. Such standards may be of the service type of watt-hour meters, but if so, such watt-hour meters shall be permanently mounted in the meter laboratory of the utility and be used for no other purpose than for checking working standards.

Reference standards of all kinds should be tested, and if necessary adjusted, at least once a year.

3. All portable watt-hour meters (rotating standards) shall be compared with the reference standards at least once a week for commutator types and once in two weeks for induction types during the time such portable testing standards are being regularly used. Unless accompanied by a calibration card, if such check shows any portable watt-hour meter (rotating standard) to be in error more than 1 per cent plus or minus at any load at which the standard will be used the meter shall be tested, adjusted, and certified in the laboratory of the utility, or in some other approved laboratory. Each portable watt-hour meter (rotating standard) shall at all times be accompanied by a certificate or calibration card, signed by the proper authority, giving the date

when it was last certified and adjusted. Records of certifications and calibrations shall be kept on file in the office of the utility.

4. All portable indicating electrical testing instruments, such as voltmeters, ammeters, and wattmeters, when in regular use for testing purposes, shall be checked against suitable reference standards at least once a week when continually in use, and if found appreciably in error at zero or more than 1 per cent of full scale value at commonly used scale deflections shall, unless accompanied by calibration card, be adjusted and certified in some approved laboratory.

MARYLAND.

El. Each utility shall on or before May 1, 1916, provide, maintain and use one or more portable indicating voltmeters for testing voltage regulation; and each utility serving more than 250 consumers shall, in addition, provide, maintain and use one or more portable recording voltmeters giving a continuous record of not less than 24 hours' duration. At least one recording voltmeter shall be kept in continuous operation at the station, or some fixed point on the utility's system within a reasonable distance of the center of distribution. Voltmeter records shall be preserved for inspection at any time by an authorized representative of the commission.

2. Each utility furnishing metered service shall, on or before April 1, 1916, provide and properly maintain and use the following meter-testing facilities:

(a) Suitable portable testing equipment to be used as working standards for testing service watthour meters, switchboard instruments, recording voltmeters and other electrical instruments in use.

(b) Suitable electrical measuring instruments and meters, to be used as reference standards, for testing the accuracy of the portable testing equipment provided for in (a) of this rule. Such reference standards may be of the service type of watthour meters, but if so such watthour meters shall be permanently mounted in the laboratory or the meter shop of the utility and to be used for no other purpose than for checking working standards.

Reference standards of all kinds will be tested, and, if practicable, adjusted by the commission at least once a year.

MICHIGAN.

16. *Standardizing laboratory.*—Each utility furnishing metered electric service shall provide and properly maintain or have available such meter laboratory, standards, and other appliances as may be necessary for making the tests required by these rules. Such laboratory and its equipment shall be acceptable to the commission, and shall be available at all reasonable times for examination by an authorized representative of the commission.

17. Whenever any utility is maintaining or shall hereafter provide and maintain a standardizing laboratory, an inspection of such laboratory may be conducted by an authorized representative of the commission, and if such laboratory, its instruments, and methods are pronounced acceptable to the commission, then a certification of such acceptability may be made by such laboratory to other utilities to whom its instruments and facilities are made available.

18. *Test standards.*—Each utility furnishing metered electric service shall provide and properly maintain such portable indicating electrical testing instruments and watthour meters of suitable range and type as may be deemed necessary and satisfactory by the commission for testing service meters, switchboard indicating and recording meters, and other electrical instruments in use.

19. For testing the accuracy of portable watthour meters, such as rotating standards, and other portable instruments used for testing service meters, each utility shall provide and properly maintain, or have available suitable secondary standards such as voltmeters, ammeters, wattmeters, watthour meters, and other electrical

instruments, to be used as reference standards for no other purpose than the checking of portable standards. Watthour meters so used as reference standards shall be permanently mounted in the meter laboratory where used.

20. *Calibration and standardizing tests.*—All portable watthour meters, such as rotating standards, shall be compared with the secondary reference standards at frequent intervals during the time such portable watthour meters are being regularly used. If such check shows any portable watthour meter to have an error of more than 1 per cent at any load at which the meter may be used, then the meter shall be tested with instruments of precision, adjusted and certified in an approved standardizing laboratory of the utility or in some other approved standardizing laboratory: *Provided, however,* That if the meter is accompanied by an accurate calibration card an error of more than 1 per cent will be allowed. Each portable watthour meter shall at all times be accompanied either by a certificate of accuracy or a calibration card, signed by the proper authorities, giving the date when it was last adjusted and certified. Records of such calibrations and certifications shall be kept available for examination by an authorized representative of the commission.

21. All portable indicating and recording meters, such as voltmeters, ammeters, wattmeters, frequency meters, and power factor meters, shall be compared with secondary reference standards at frequent intervals during the time such meters are being regularly used. If such check shows an error at ordinarily used scale deflections of more than 1 per cent of full-scale value, then the meter shall be tested with instruments of precision, adjusted, and certified in an approved laboratory: *Provided, however,* That if the meter is accompanied by an accurate calibration card an error of more than 1 per cent will be allowed.

22. All watthour meters used as secondary reference standards for the checking of portable watthour meters shall be tested with instruments of precision, adjusted, and certified at least once every six months in an approved standardizing laboratory. All secondary standards used for checking portable or other indicating electrical instruments shall be tested with properly verified primary standards, adjusted, and certified at least once every year in an approved standardizing laboratory. Each secondary reference standard shall at all times be accompanied either by a certificate of accuracy or a calibration card, signed by the proper authorities giving the date when it was last adjusted and certified.

MISSOURI.

RULE 35. Each utility furnishing metered electric service shall maintain suitable working standards of a rugged type for the testing of electric service meters. These working standards must be calibrated frequently to insure their accuracy.

Approved secondary standards shall be owned and maintained by each utility having more than 250 meters in service, for the calibration of the working standards.

All secondary standards, and the working standards of those utilities not required to maintain secondary standards, must be submitted, at sufficiently frequent intervals to insure unquestionable accuracy, to the engineering laboratories of the State University at Columbia, Mo., or the Bureau of Standards at Washington, D. C., or to some testing laboratory of recognized standing, for calibration where the utility does not maintain a testing laboratory having primary standards.

Each standard shall be accompanied by its certificate of calibration dated and signed by the proper authority. These certificates, when superseded, shall be kept on file at the office of the utility, available for inspection.

Meter-testing equipment shall at all reasonable hours be accessible for inspection and use by any authorized representative of the commission.

MONTANA.

RULE 27. *Meter-testing equipments.*—(a) *Standardizing laboratory and equipment.*—Each utility furnishing metered electric service to more than 250 consumers, unless

specifically excused by the commission, shall establish and maintain a standardizing laboratory equipped with standard meters, instruments, and such facilities as may be necessary to make the tests required by these rules. Such equipment and facilities shall be acceptable to the commission and shall be available at all reasonable hours for the inspection of any authorized representative of the commission.

(b) Each utility furnishing metered electric service to more than 30 consumers shall provide for and have available such portable indicating electrical testing instruments for testing service watthour meters, voltmeters, and other electrical instruments in use as may be deemed necessary and satisfactory by the commission.

(c) *Reference standards.*—For testing the accuracy of portable watthour meters, commonly called rotating standards, and other portable instruments used for testing service meters, each utility, not specifically excused by the commission, shall provide for and have available as reference or check standards suitable indicating electrical instruments and watthour meters, hereafter called "reference standards." Such standards may be of the service type of watthour meters, but, if so, such meters shall be permanently mounted in the utility's laboratory or office and be used for no other purpose than for checking working standards.

Reference standards of all kinds should be tested, and if necessary adjusted, and certified in some approved laboratory at least once each year.

(d) Rotating standards shall be compared with the reference standards at least once a week for commutator types and once in two weeks for induction types during the time such portable testing standards are being regularly used. Unless accompanied by a calibration card, if such check shows any portable rotating standard to be in error more than 1 per cent plus or minus at any load at which the standard will be used, the meter shall be tested, adjusted, and certified in the laboratory of the utility or in some other approved laboratory. Each portable rotating standard shall at all times be accompanied by a certificate or calibration card, signed by the proper authority, giving the date when it was last certified or adjusted. Records of certification and calibration shall be kept on file in the office of the utility.

(e) All portable indicating electrical testing instruments, such as voltmeters, ammeters, when in regular use for testing purposes, shall be checked against suitable reference standards at least once a week when continually in use, and if found appreciably in error at zero or more than 1 per cent of full-scale value at commonly used scale deflection shall, unless accompanied by a calibration card, be adjusted and certified in some approved laboratory.

NEVADA.

RULE 19. Each company supplying electrical energy shall provide itself with suitable equipment for the testing of meters, and shall employ such methods as are approved by the Public Service Commission.

NEW HAMPSHIRE.

RULE 9. Each utility furnishing metered electric service shall have available, in proper working condition, suitable standards for testing its meters, and shall either maintain these standards correct within one-half of 1 per cent or apply the proper corrections to all tests.

NEW JERSEY.

No. 17. (1) All utilities supplying electricity within the State of New Jersey shall provide and properly maintain suitable apparatus and facilities for testing and proving the accuracy of watthour meters.

(2) All portable standards shall be tested and proved as to their accuracy as often as is necessary to insure their maintenance in proper condition for testing of watthour meters. Portable standards, if not tested and calibrated in the laboratory of the electrical utility owning the same, shall be tested and calibrated in any properly equipped laboratory of recognized standing. Each standard shall at all times be accompanied

by a certificate giving the date it was last checked. The correction to be applied at various loads and signed by the proper authority.

These certificates when superseded shall be kept on file in the utility's office.

NO. 21. Each utility supplying electricity shall equip itself with a rotating standard test meter of suitable range, and shall fasten permanently on the wall of the meter shop a house or switchboard type meter or meters of suitable capacity, to be used only for checking the rotating standard.

This check should be made at least every week when standard is in service. Utilities supplying direct current or having already other test apparatus, or small utilities having less than 100 meters, may apply to the commission for a modification of this rule. Each wall standard shall be tested at least once a year and certified by the board and furnished with an inspection tag or plate. Rotating standards will not be sealed, but wall standards will be sealed and are to be considered the reference standard for the utility. Where a utility is maintaining a standardizing laboratory, inspection will be made of the instruments in use in this laboratory, and if the instruments and methods are approved, certification of rotating and wall standards may be made by such laboratory.

NEW YORK.

SECTION 24. *Standardizing laboratory.*—The electrical laboratory of an electrical corporation may be approved as a standardizing laboratory provided it is equipped with acceptable types of precision instruments, standards and other necessary apparatus, installed and maintained in a manner acceptable to the commission.

The standardizing laboratory may certify meters and instruments for testing purposes for its own use and for other electrical corporations.

SECTION 25. *Testing facilities and equipment.*—Each electrical corporation shall, unless specifically excused by the commission, provide for and have available such laboratory, standard meters, instruments, and other facilities as may be deemed necessary to properly make the tests required by the rules herein contained. Such equipment and facilities shall be acceptable to the commission and shall be available at all reasonable times for inspection by authorized representative of the commission.

SECTION 26. *Reference standards.*—For determining the accuracy of portable watt-hour meters, commonly called rotating standards and other portable instruments used for testing watt-hour meters, each electrical corporation shall provide for and have available as reference standards suitable indicating electrical instruments mounted in a permanent position.

Reference standards shall be certified once in every two months by comparison with the standards of a standardizing laboratory or the standards of the commission or by specific permission with the standards of other laboratories.

SECTION 27. *Portable rotating standards.*—All portable watt-hour meters (rotating standards) shall be compared with the reference standards at least once a week for commutator types and once in two weeks for induction types during the time such portable standards are regularly used. If such comparison shows a portable standard to be in error more than 1 per cent plus or minus at any load at which the standard will be used, it shall be adjusted and certified by comparison with reference standards in the company's own laboratory before being again used. Each portable watt-hour meter (rotating standard) shall at all times be accompanied by a certificate, signed by the proper authority, giving the date when last certified and the company's or the manufacturer's number. The accuracy certification may be shown in per cent accuracy of the portable standard or in the correction in per cent to be applied at the various ampere loads on one or more voltage ranges or both percentages may be shown. The certificates shall be uniform in size and arrangement of form and when superseded shall be filed for a period of six months.

SECTION 29. *Portable indicating standards.*—All portable indicating electrical testing instruments when in regular use for testing purposes shall be checked against

suitable reference standards at least once a week when continually in use and if found appreciably in error at zero or in error more than 1 per cent of full-scale value at commonly used scale deflections, shall, unless accompanied by a calibration card, be adjusted and certified by comparison with reference standards in the company's own laboratory.

NORTH DAKOTA.

RULE 11. Meter testing equipment and facilities.—(a) *Standardizing laboratory.*—Whenever any utility is maintaining or shall hereafter establish and maintain a standardizing laboratory, periodic inspection by the commission will be made of the instruments and methods in use, and if instruments and methods are acceptable to the commission after such inspection, certification of meters and instruments for its own use and for other utilities may be made by such laboratory.

(b) *Equipment and facilities.*—Each utility furnishing metered electric service shall, unless specifically excused by the commission, provide for and have available such meter laboratory, standard meters, instruments, and other equipment and facilities as may be necessary to make the tests required by these rules. Such equipment and facilities shall be acceptable to the commission, and shall be available at all reasonable times for the inspection of any authorized representative of the commission.

(c) *Test standards:* 1. Each utility furnishing metered electric service shall provide for and have available such portable indicating electrical testing instruments or watthour meters of suitable range and type for testing service watthour meters, switchboard, instruments, recording voltmeters, and other electrical instruments in use as may be deemed necessary and satisfactory by the commission.

2. For testing the accuracy of portable watthour meters, commonly called "rotating standards," and other portable instruments used for testing service meters, each utility, not specifically excused by the commission as provided for in section (b) of this rule, shall provide for and have available as reference or check standards suitable indicating electrical instruments, wattmeters, watthour meters, or any or all of them hereafter called reference standards. Such standards may be of the service type of watthour meters, but if so, such watthour meters shall be permanently mounted in the meter laboratory of the utility and be used for no other purpose than for checking work in standards.

Reference standards of all kinds should be tested and, if necessary, adjusted at least once a year.

3. All portable watthour meters (rotating standards) shall be compared with the reference standards at least once a week for commutator types and once in two weeks for induction types during the time such portable testing standards are being regularly used. Unless accompanied by a calibration card, if such check shows any portable watthour meter (rotating standard) to be in error more than 1 per cent, plus or minus, at any load at which the standard will be used the meter shall be tested, adjusted, and certified in the laboratory of the utility, or in some other approved laboratory. Each portable watthour meter (rotating standard) shall at all times be accompanied by a certificate or calibration card, signed by the proper authority, giving the date when it was last certified and adjusted. Records of certifications and calibrations shall be kept on file in the office of the utility.

4. All portable indicating electrical testing instruments, such as voltmeters, ammeters, and wattmeters, when in regular use for testing purposes, shall be checked against suitable reference standards at least once a week when continually in use, and if found appreciably in error at zero or more than 1 per cent of full-scale value at commonly used scale deflections shall, unless accompanied by calibration card, be adjusted and certified in some approved laboratory.

OREGON.

RULE 2. *Testing facilities.*—(a) Each utility shall provide such laboratory, meter testing shop, and other facilities as may be necessary to make the tests required by these rules. All tests made by any utility under these rules shall be carried out in a manner and at such places as may be approved by the commission, and the apparatus and equipment used for these tests shall be at all times available for the inspection or use of any member or authorized representative of the commission.

RULE 20. *Meter-testing equipment.*—Every electric utility furnishing metered service shall own suitable working standards for the testing of electricity meters, and either maintain these standards correct within one-half of 1 per cent, or apply the proper correction to all tests. Secondary standards of some approved type shall be owned and maintained by each utility having more than 250 electricity meters in service.

OKLAHOMA.

RULE 12. *Meter testing facilities and equipment.*—(a) *Standardizing laboratory.*—Whenever any utility is maintaining or shall hereafter establish and maintain a standardizing laboratory, periodic inspection by the commission will be made of the instruments and methods in use, and if instruments and methods are acceptable to the commission after such inspections, certification of meters and instruments for its own use and for other utilities may be made by such laboratory.

(b) *Facilities and equipment.*—Each utility furnishing metered electric service shall, unless specifically excused by the commission, provide for and have available such meter laboratory, standard meters, instruments, and other equipment and facilities as may be necessary to make the tests required by these rules. Such equipment and facilities shall be acceptable to the commission, and shall be available at all reasonable times for the inspection and use by any authorized representative of the commission.

(c) *Test standards.*—(1) Each utility furnishing metered electric service shall provide for and have available portable indicating electrical testing instruments or watthour meters of suitable range and type for testing service watthour meters, switchboard instruments, recording voltmeters, and other electrical instruments in use.

(2) For testing the accuracy of portable watthour meters, commonly called "rotating standards," and other portable instruments used for testing service meters, each utility, not specifically excused by the commission as provided for in section (b) of this rule, shall provide for and have available as *reference or check standards*, suitable indicating electrical instruments, wattmeters, watthour meters, or any or all of them, hereafter called reference standards. For utilities having less than 500 meters in service such reference standard may be of the service type of watthour meter, but, if so, such watthour meter shall be permanently mounted in a place as free as possible from vibration and other disturbing influences and shall be used for no other purpose than for checking working standards.

Reference standards of all kinds shall be tested, and, if necessary, adjusted at least once a year in a standardizing laboratory which is maintained as provided for in (a) of this rule.

(3) All portable watthour meters (rotating standards) shall be compared with the reference standards at least once a week for commutator types and once in two weeks for induction types during the time such portable testing standards are being regularly used. Unless accompanied by a calibration card, if such check shows any portable watthour meter (rotating standard) to be in error more than 1 per cent plus or minus at any load at which the standard will be used the meter shall be tested, adjusted, and certified in the laboratory of the utility, or in some other approved laboratory. Each portable watthour meter (rotating standard) shall at all times be accompanied

by a certificate or calibration card, signed by the proper authority, giving the date when it was last certified and adjusted. Records of certifications and calibrations shall be kept on file in the office of the utility.

(4) All portable indicating electrical testing instruments, such as voltmeters, ammeters, and wattmeters, when in regular use for testing purposes, shall be checked against suitable reference standards at least once a week when continually in use, and if found appreciably in error at zero or more than 1 per cent of full-scale value at commonly used scale deflections shall, unless accompanied by calibration card, be adjusted and certified in some approved laboratory or by the commission.

PENNSYLVANIA.

NO. 15. Each utility shall provide for and have available suitable and adequate facilities for testing its watthour meters, in each case to be satisfactory to and approved by the commission. These facilities shall, in general, include a test bench free from unnecessary incumbrances, one or more portable rotating standard watthour meters, a suitable check meter or meters mounted on the test bench, and such other necessary equipment as the commission may require. The check meter shall be the reference standard for the utility, and shall be periodically tested for accuracy and adjusted when necessary by a representative of the commission, and at such place as the commission may direct. Immediately after making final adjustment, the tester shall seal and date tag the meter, and shall furnish the utility with a correction curve properly dated and signed. The portable rotating standard shall also be tested and adjusted periodically by a representative of the commission, and at such place as the commission may direct. The tester shall furnish the utility with a correction curve properly dated and signed.

During the interval between tests by the commission the portable standard shall be compared with the check meter at least once each week (for commutating types) and at least once every two weeks for induction types during the time the portable meter is in service, and the calibration thus obtained shall be used in determining the error of the service meters. A complete record of these check tests shall be kept for at least two years, as specified in rule 10. This record shall show the condition and accuracy of the rotating standard "as found" and "as left," all in such form and such detail as to permit of convenient checking of the method and results.

All correction curves furnished by the commission shall be kept with the meter until superseded. After January 1, 1915, tests made with uncertified facilities will not be deemed authoritative.

SOUTH CAROLINA.

RULE 13. *Testing facilities.*—(a) Each utility furnishing metered electric service shall, unless specifically excused by the commission, provide and have available such meter laboratory, standard meters, instruments, and facilities as may be necessary to make the tests required by these rules, together with such portable indicating electrical testing instruments, watthour meters, and facilities of suitable type and range for testing service watthour meters, voltmeters, and other electrical equipment, used in its operations, as may be deemed necessary and satisfactory to the commission.

(b) All portable indicating electrical testing instruments, such as voltmeters, ammeters, and wattmeters, when in regular use for testing purposes, shall be checked against suitable reference standards periodically, and with such frequency as to insure their accuracy whenever used in testing service meters of the utility.

WASHINGTON.

RULE 23. Each company supplying electric current shall, when required by the commission, provide itself with suitable equipment for the testing of meters and shall employ such methods of testing as are approved by the commission.

WEST VIRGINIA.

RULE 10. Meter testing facilities and equipment.—(a) *Facilities and equipment.*—Every utility furnishing metered electric service shall, unless specifically excused by the commission, provide for and have available such laboratory, meter-testing shop, standard meters and instruments, and other equipment and facilities as may be necessary to make the tests required by these rules or other orders of the commission. Such equipment and facilities shall be satisfactory to and approved by the commission, and shall be available at all reasonable times for the inspection and use of any authorized representative of the commission.

(b) *Testing standards.*—1. Each utility furnishing metered electric service shall provide and have available portable indicating electrical testing instruments and portable watthour meters of suitable range and type for testing service watthour meters, switchboard instruments, recording voltmeters, and other electrical instruments in use, as may be deemed necessary and approved by the commission.

2. For testing the accuracy of portable watthour meters, commonly called "rotating standards," and other portable instruments used for testing consumers' service meters, every utility not specifically excused by the commission as provided in section (a) of this rule, shall provide for and have available as reference or check standards, suitable indicating electrical instruments, wattmeters, watthour meters, or any or all of them, hereafter called reference standards. Such standards may be of the service type of watthour meters, but if so, such watthour meters shall be permanently mounted in the laboratory or meter shop of the utility, and shall be used for no other purpose than for checking rotating standards. All reference standards will be tested, adjusted, and sealed by the commission at least once a year.

3. All portable watthour meters (rotating standards) shall be compared with the reference standards at least once a week for commutator types and once in two weeks for induction types during the time such portable testing standards are being regularly used. If after five readings all of which check within 1 per cent, such check shows any portable watthour meter (rotating standard) to be in error more than one-half per cent, plus or minus, at light load or heavy load, as defined in rule 11, and more than 1 per cent, plus or minus, at any intermediate load, the meter shall be tested, adjusted, and certified either by the commission or by the meterman of the utility in the laboratory of the utility if approved by the commission, or in some other approved laboratory, before being again used. Every portable watthour meter (rotating standard) shall at all times be accompanied by a certificate giving the date when it was last certified and adjusted, the corrections to be applied at various loads, and signed by the proper authority. These certificates when superseded shall be kept on file in the office of the utility.

4. All portable indicating electrical-testing instruments, such as voltmeters, ammeters, and wattmeters, when in regular use for testing purposes, shall be checked against reference standards at least once a week when continuing in use.

(c) *Standard laboratories.*—Any utility maintaining or which shall hereafter establish a standardizing laboratory, inspection by the commission will be made of the instruments in use, and if instruments and methods are approved by the commission after such inspection, certification of portable reference standards may be made by such laboratory.

WISCONSIN.

RULE 19. Each utility furnishing metered electric service shall own suitable working standards for the testing of electricity meters, and either maintain these standards correct within one-half of 1 per cent or apply the proper correction to all tests. Secondary standards of some approved type shall be owned and maintained by each utility having more than 250 electricity meters in service.

METER-TESTING METHODS AND PLACE.

CONNECTICUT.

RULE E-13. Place and method of testing.—(a) All tests of meters provided for in rules 5, E-15, E-16, and E-17 shall be made in the place of permanent location on the customers' premises with approved testing apparatus and under local conditions, unless otherwise stated in any rule.

(b) Meters installed with instrument transformers or shunts may be tested in dependence of such transformers or shunts, provided the utility applies the corrections indicated by a certificate from the manufacturer exhibiting the characteristics of the type of transformer or shunt in question and guaranteeing the limits of deviation of individual transformers or shunts from the average characteristics of the type; otherwise the meters and transformers or shunts shall be verified as a measuring unit.

DISTRICT OF COLUMBIA.

SECTION 2. Testing rules.—All tests made pursuant to these regulations shall be made in compliance with the following rules:

(A) All instruments used as standard instruments in testing meters shall be equipped with scales properly proportioned to the loads measured.

(B) Tests shall be made with the meter in its permanent position on the consumer's premises, and as nearly as possible under operating conditions as regards voltage, frequency, temperature, stray fields, vibration, etc.

(C) When practicable, all meters shall be tested at the following loads: Light load (10 per cent of rated capacity of meter), full load (60 per cent to 100 per cent of rated capacity of meter). On request tests and on referee tests, however, the meter shall also be tested at normal load. In the case of an installation on which it is not practicable to obtain these loads, tests shall be made at loads as near as possible to these. In a case in which the full connected installation³⁹ amounts to less than the rated capacity of the meter, the full connected installation may be taken as the full load of the meter. In determining the normal load the following percentages of the several classes of the full connected installation shall be used:

	Per cent.
A. Residence and apartment lighting.....	25
B. Elevator service.....	40
C. Factory lighting, individual drives, churches, offices, stables, hotels.....	45
D. Factory shaft drives, theaters, clubs, hallways, entrances, and general store lighting	60
E. Saloons, restaurants, pumps, air compressors, and ice machines.....	70
F. Sign and window lighting, blowers, moving-picture machines.....	100

When a meter is found to be connected to an installation consisting of several of the above classes of loads, the normal load shall be obtained by multiplying the connected watt load of each class by the percentage specified above and adding the results.

(D) Two tests shall be made at each load at which the meter is tested, but should these two tests fail to agree within 0.8 per cent additional tests shall be made until two results are obtained which do agree within 0.8 per cent. On all tests each reading shall cover a period of at least 30 seconds.

(E) Where potential transformers are used in connection with a meter and the line voltage does not exceed 600 volts, the meter shall be tested from the line side of such apparatus. Where current transformers are used in connection with a meter and the line voltage does not exceed 600 volts and the current capacity of the transformer does not exceed 150 amperes, the meter shall be tested from the line side of such apparatus.

³⁹ The full connected installation includes all electrical apparatus found connected and capable of being put in practical operation by the closing of a switch or switches, the installing of fuses, or the operation of controlling devices.

Where potential or current transformers are used in connection with a meter and the line voltage exceeds 600 volts or the capacity of the current transformer exceeds 150 amperes, the meter may be tested as a self-contained meter and the ratio certificates of the transformers may be used in calculating the true line watts, provided that, in the case of request and referee tests, said certificates are dated within the year preceding the date of test of the meter and, in the case of all other tests, said certificates are dated within the five years preceding the date of test of the meter.

(F) Where shunts are used in connection with a meter and the current capacity of the shunts does not exceed 600 amperes, the meter shall be tested from the line side of such apparatus. At each test, the voltage drop through the shunt leads, the meter, and their connections should be measured in order to determine whether it has changed since previous tests.

When the current capacity of the shunts exceeds 600 amperes, the meter may be tested as a self-contained meter, and the calibration certificates of the shunts may be used in calculating the true line watts, provided that, in the case of request and referee tests, said certificates are dated within the year preceding the date of test of the meter and, in the case of all other tests, said certificates are dated within the five years preceding the date of test of the meter.

(G) After test, a meter shall be adjusted by the electrical corporation so as to register with an error of not more than 1 per cent at light and full loads when compared with a working standard and so as to be without creep.

ILLINOIS.

RULE 9. *Meter test loads and errors.*—(a) Service watthour meters shall be tested on the following loads:

Commutator and mercury type meters—

Light load Approximately 10 per cent of rated capacity of meter.

Heavy load Approximately 75 per cent of rated capacity of meter.

Induction type meters—

Light load 5 to 10 per cent of rated capacity of meter.

Heavy load Approximately 75 per cent of rated capacity of meter.

Two test runs, each at least 30 seconds long, shall be made and recorded at each load, but should these tests fail to agree within 1 per cent for light load and within one-half of 1 per cent for heavy load additional tests shall be made until two results are obtained which do so agree. The error on each load shall then be obtained by averaging the errors from the two tests which agree as specified. The errors on the two loads shall then be averaged; proper account being taken of the sign of the errors. The results shall be considered the average error of the meter.

(b) The electrical element of curve drawing instruments when used as demand meters should be tested on a steady load at approximately two-thirds of the rated capacity of the instrument. The timing element of these instruments may be checked by comparing the time as indicated by the chart with the correct time. The error of the instrument will be the error shown by the test of the electrical element.

The electrical element of integrated demand meters should be tested in accordance with the rules given for watthour meters in paragraph (a). The timing element of integrated demand meters should be given a stopwatch test of the number of revolutions or clock beats in sixty seconds, or in meters which record the time of demand may be checked by comparing the time as indicated by the tape or chart with the correct time. The error of the instrument should be computed from the results of the tests of the electrical and timing elements.

Lagged demand meters of the electro-magnetic type should be tested on a steady load of approximately two-thirds full scale value, maintained for the time interval of the meter, or until it has reached final deflection. When construction permits, the

escapement mechanism may be disengaged so that the above check may be made in a short time. Lagged demand meters of the thermal type should be tested on a steady load of from two-thirds to full rated capacity of the meter, maintained until final registration is reached. The error of lagged demand meters is the error of final registration.

MARYLAND.

6. (c) All tests on watthour meters in service shall be made in the place of permanent location on the consumers' premises with approved testing apparatus and under local conditions of operation, unless otherwise stated in any rule or allowed by special order of the commission.

MICHIGAN.

23. *Methods for testing meters.*—The average error of a service watthour meter shall be determined as follows:

(a) The error at light load, here defined as approximately 10 per cent of the rated full-load capacity of the meter, shall be determined by taking the average of at least two errors, determined from as many separate tests on the same light load, which errors must agree within one-half of 1 per cent.

(b) In the same manner the error at heavy load, here defined as a load of approximately 75 per cent of the rated full-load capacity of the meter, shall be determined.

(c) The average error of the meter shall then be determined by taking an average of the error at light load and the error at heavy load, proper account being taken of the sign of these two errors: *Provided, however,* That where the consumer's connected load does not equal 75 per cent of the rated full-load capacity of the meter, the full connected load may be considered as heavy load for the purpose of the test.

30. Each watthour meter installed with instrument transformers or shunts shall be tested jointly with transformers and shunts: *Provided, however,* That if the phase angle and ratio of transformation of the transformers or the calibration of the shunts is verified at the time of installation of the meter, and the meter accordingly adjusted, such tests shall not be required. Instrument transformers used for meters should not be used also for operating relays.

MISSOURI.

RULE 29. Each electric service watthour meter placed in service shall be tested and adjusted for accuracy before installation or within 30 days thereafter. It is recommended, however, that this installation test be made after the meter has been set in its permanent location and at the same time it can be checked for suitable location, mechanical condition, and correct connection.

Tests and adjustment for accuracy shall be made at from 5 to 10 per cent, 50 per cent, and 100 per cent of rated capacity of meter. Where normal load under which meter operates will fall between 60 per cent and 100 per cent of rated capacity of meter, and equivalent test load may be substituted in place of the 50 per cent and 100 per cent rated capacity test loads.

Tests for accuracy at each load shall be made with suitable working standards by taking the average of at least two test runs of at least 30 seconds each which agree within 1 per cent.

Any meter operating on inductive load should be tested under the approximate power factor conditions at which the meter will normally be required to operate.

Each meter when tested shall be adjusted as accurately as practical for correct registration at the test loads specified. Where necessary to adjust the meter fast at light or heavy load, for correct registration at normal load, or to correct for inductive load such fast adjustment should not exceed 2 per cent above correct registration.

Commutator type meters should, when feasible, be allowed to remain in actual service at least five days before being tested.

MONTANA.

(d) Meters operating on inductive circuits shall be tested on the connected load under conditions approximating as near as may be, to heavy and light loads, and shall be adjusted if necessary so that the average error will not be more than 2 per cent.

NEW JERSEY.

No. 23. Each meter after being tested as found shall be adjusted to record within 2 per cent of correct at heavy load and not more than 2 per cent fast nor 4 per cent slow at light load. This periodic test is to be made by comparing the meter while connected in its place of service with an approved standard at light load and heavy load. Meters removed from service are to be tested and adjusted in the meter room before being put in service again.

NEW YORK.

SECTION 10. All tests on watthour meters in service provided for in these rules shall be made in the place of permanent location on the consumers' premises and under local conditions of operation.

SECTION 11. Meters installed with instrument transformers, which are connected to circuits exceeding 350 volts, shall be provided with a ratio certificate for each transformer. The meter shall be tested independently, and the corrections shown on the ratio certificates, applied in the determination of the meter's registration in per cent. Meters installed with instrument transformers or shunts connected to circuits not exceeding 350 volts need not be provided with certificates of ratio for the transformers or certificates of potential drop for the shunts, provided such meters are tested so as to include the transformers or shunts in the test circuits.

SECTION 12. Whenever the primary circuit supplying a current transformer connected to a watthour meter can not be open circuited for the purpose of testing, an approved type of protective device shall be permanently installed to short circuit the transformer secondary when required, so that the possibility of injury to persons or the changing of the transformer ratio is minimized.

SECTION 13. In periodic or office meter tests, the calibration certificate of the transformer or the shunt shall be dated within a period not exceeding 10 years prior to the time the meter is tested.

SECTION 14. In complaint tests, the commission will accept the calibration certificates of the transformers or the shunts provided they are dated within a period of two years preceeding the time the meter is tested.

SECTION 15. Shunts for testing direct current watthour meters exceeding 800 amperes rated capacity may be permanently installed for obtaining current measurements provided there is on file a calibration certificate of the shunt dated within the period stated in section 13 for periodic or office tests, or within the period stated in section 14 for complaint tests.

SECTION 16. All watthour meters tested as defined in section 2 (periodic tests) shall be tested at three load points as specified below:

Light load, at 10 per cent of rated capacity of the meter.

Normal load, at a point ranging from 50 per cent to 60 per cent of rated capacity of the meter.

Full load, at a point ranging from 85 per cent to 100 per cent of rated capacity of the meter.

When meters are connected to and tested in conjunction with instrument transformers or shunts, the nominal rating of the transformers or shunts shall be considered as the rated capacity of the meter.

SECTION 17. *Classification of normal load.*—The classification and percentage of installation to be used when testing watthour meters at normal load on complaint or office tests are given below:

	Per cent.
A. Residence and apartment lighting.....	25
B. Elevator service.....	40
C. Factories (individual drive), churches and offices.....	45
D. Factories (shaft drive), theatres, clubs, entrances, hallways and general store lighting.....	60
E. Saloons, restaurants, pumps, air compressors, ice machines and moving-picture theatres.....	70
F. Sign and window lighting and blowers, battery charging.....	100

SECTION 18. When a watthour meter is found to be connected to an installation consisting of two or more of the above classes of loads, the normal load shall be obtained by multiplying the connected watt load of each class by the percentage specified above and adding the results.

SECTION 19. The normal load determination for complaint and office tests shall include every power, lighting and heating device found so connected that the same may be properly operated by installing fuses, closing a switch or operating a controlling device, or by any combination of these three methods.

BULLETIN NO. E 1.—I. 1. All tests of consumers' meters shall be made with apparatus which has been approved and stamped or marked by the commission.

2. The percentage registration of a meter at any point shall be determined by dividing the observed meter watts by the standard watts and expressing the result as a percentage of the standard watts.

3. Meters shall be tested under actual operating conditions as regards voltage, frequency, power factor, temperature, stray fields, and vibration as nearly as possible.

4. The light load test shall be made at a point approximately one-tenth the full rated capacity of the meter: *Provided*, That companies now testing their meters at one-twentieth rated capacity for light load point may continue that practice at their option in lieu of the test at one-tenth rated capacity, indicating the same upon report blank.

5. The test at normal load should be made whenever the normal load of the consumer can be approximately determined.

6. The full load test shall be made at approximately the full-rated capacity of the meter in all cases except when full connected load of the installation is less than the full rated capacity of the meter, in which case tests shall be made at the full connected load.

7. In addition to the tests at light, normal, and full load, provision is made on the blanks for reporting tests at other load points should such additional tests be made.

8. Meters shall be tested at the point of installation whenever possible, preferably using the connected load. The place of test of each meter shall be specified on the report blank as "plant," "premises," or elsewhere.

OKLAHOMA.

RULE 15. *Place and methods for meter testing.*—(a) All tests on watthour meters and demand meters in service provided for in these rules, shall be made in the place of permanent location on the customer's premises with approved testing apparatus and under the local conditions of operation, unless otherwise stated in any rule or allowed by special order of the commission.

(b) Watthour meters installed with instrument transformers or shunts shall be tested jointly with such transformers or shunts, otherwise the ratio of transformation of the transformers and the resistance of the shunts must have been previously determined within 10 years and be on file at the office of the utility for use in calculating results

of tests made. All such calibration tests must have been made by a laboratory of recognized standing or by the utility using apparatus and methods satisfactory to the commission.

OREGON.

RULE 4. Meter testing.—(a) Every meter hereafter installed for measuring gas, electric current, heat, or water to any customer shall be tested and, if necessary, repaired and adjusted by the utility installing it before being placed in use, or in the case of electricity meters, within 30 days thereafter, as provided by rule 21; and every meter tested (except water meters installed underground) shall have firmly attached thereto a tag or label, or be stenciled, giving the date of test, which tag, label, or stenciled mark shall not be defaced or removed until a subsequent test shall have been made.

PENNSYLVANIA.

No. 19. Power factor adjustment.—All alternating current watthour meters which are provided with a power factor adjustment should be tested and adjusted for correct registration within 2 per cent plus or minus, at 100 per cent power factor and within 4 per cent at zero or 50 per cent power factor lagging before installation. All alternating current watthour meters in service which have not been so tested and adjusted before installation, and which are connected to circuit supplying other than non-inductive load, shall be tested for accuracy at 100 per cent power factor and at zero or 50 per cent lagging power factor. In all cases where it is not practicable to determine the error of the meter at these power factors, the utility shall have the option of installing an approved check meter, and determining the error as provided in the last paragraph of rule 12.

No. 20. Place of making tests.—All tests provided for in rules 14, 16, and 18, and except those made previous to installation as provided for in rule 14, shall be made in the place of permanent location on the consumer's premises, with approved equipment and under local conditions.

No. 21. Watthour meter tests without accessories.—In all cases where a watthour meter is connected to the line through shunts, multipliers, or instrument transformers, the test may be made on the meter as a self-contained unit and the ratio of the accessories used to determine the error of the meter, provided that the certificates of the accessories bear a date within five years and are satisfactory to the commission.

No. 22. Adjustment after test.—All service watthour meters shall be adjusted after test that the error as defined in rule 12 shall not exceed 2 per cent. Neither shall the error at light load exceed 4 per cent nor the error at heavy load exceed 2 per cent.

WASHINGTON.

No. 3. Every meter for measuring gas, electric current, or water which has been tested for accuracy by the company furnishing the substance measured, or by an inspector appointed by the commission, shall have firmly attached thereto a tag or label giving the number, size (or capacity) of the meter, the date and result of such test, and by whom made. No such card or label shall be defaced or removed until a subsequent test shall be made and a later test record attached. Each of such tags or labels shall have printed thereon the substance of this provision. This rule shall not apply to water meters when set outside of a building underground and in such a position as to make them liable to become submerged. Whenever any test has been made at the request of a consumer, the latter shall be notified in writing within 10 days thereafter by the company, such written notification to contain all information hereinbefore mentioned.

WEST VIRGINIA.

RULE 12. Place and methods of testing.—(a) Every watthour meter, before installation on any consumer's premises, shall be tested for accuracy of registration by a

competent meterman, employed by the public service corporation, whose selection has been approved by the commission, and who has taken the oath of office required of all employees of the commission.

(b) After all necessary repairs, adjustments, and final tests have been made so that the meter registers accurately to within 2 per cent as specified in rule 11, the meter shall be sealed and tagged with seals and date tags furnished by the Public Service Commission.

(c) All tests on watthour meters in service provided for in these rules shall be made in the place of permanent location on the consumer's premises with approved testing apparatus and under local conditions, unless otherwise stated in any rule or allowed by special order of the commission.

(d) The results of all tests and adjustments and data sufficient to allow checking of test calculations shall be recorded by the meterman in duplicate on blanks furnished by the Public Service Commission, and the original test record so obtained shall be filed with the commission within 30 days after making the test. All seals, date tags, and meter-test blanks used shall be charged to and paid for by the utility at their actual cost and carriage. Every utility shall provide and use such copper or galvanized sealing wire as the commission may prescribe.

(e) Meters installed with instrument transformers or shunts shall be tested jointly with such transformers or shunts, otherwise the ratio of the transformation of the transformers and the resistance of the shunts must have previously been determined within five years and be on file at the office of the utility. Such tests must have been made by a laboratory of recognized standing, or by the utility, using apparatus and methods approved by the commission.

METER RECORDS.

ARIZONA.

RULE 16. A complete record shall be kept of all tests made of electric meters.

COLORADO.

RULE 6. *Records of tests and of meters.*—(a) A complete record of the tests made under these rules of the quality and condition of service shall be kept by each utility. The record so kept shall contain full information concerning each test, including the date, and the place where the test was made, the name of the employee conducting the test, the result of the test, and such other information as may be required by these rules, or as this commission may from time to time direct, or as the utility making the test may deem desirable.

(b) Whenever any service meter is tested the original test record shall be preserved, including the information necessary for identifying the meter, the reason for making the test, the reading of the meter if removed from service, and the result of the test, together with all data taken at the time of the test in sufficiently complete form to permit the convenient checking of the methods employed and the calculations made.

(c) A record shall also be kept indicating for each meter owned or used by any utility, the date of purchase, manufacturer's serial number, record of the use, and tests to which it has been subjected, and its present location.

CONNECTICUT.

RULE 3. *Record of tests, history of meters.*—(a) A complete record of each test of quality, service, conditions or meter accuracy as made under these rules shall be kept by each utility accessible to the commission, or its authorized representatives.

(b) Each record of tests of quality or of service conditions so kept shall contain complete information concerning the test including such items as the commission may from time to time require.

(c) In the case of any service-meter test the original records shall be preserved indicating the information necessary for identifying the meter, the reading of the meter before being disturbed, the computed accuracy of registration both as found and as left, together with the data taken at the time of the test in sufficiently complete form to permit the convenient checking of the methods employed and of the computations leading to the result.

(d) Records shall be kept, systematically arranged, indicating the approximate date of purchase of each meter, its size or capacity rating, its various places of installation, the date of each repair, adjustment, or test, the reason for making such test, and the general result of each test.

(e) All the above-mentioned records shall be preserved for at least three years, excepting service-meter records under rule 3-d, which shall be preserved until the meter is destroyed or permanently removed from service.

DISTRICT OF COLUMBIA.

SECTION 8. Each corporation shall keep a complete record of each request, periodic, and inquiry (or office) test made by it of meters installed on consumers' premises. Such records shall include: Owning corporation's number, manufacturer's name and number, type, rated volts and amperes, wire, and the average readings at light load, at normal load, and at full load.

Each corporation shall keep a record of the dates on which its meters are installed in and removed from the service of consumers.

ILLINOIS.

RULE 2. *Meter records.*—A record shall be kept giving the following information for each watthour meter, demand meter, instrument transformer, or shunt owned or in service: Date of purchase, company's number, name plate data, places of installation with dates of installation and removal, reason for removal, dates and general results of tests, repairs, and final disposition.

RULE 3. *Meter test records.*—(a) Each utility shall keep records of all tests of the accuracy of its meters. These records shall give (1) sufficient information to identify the meter, (2) the reason for the test, (3) the time of the test and reading of the meter, (4) the name of the person making the test, (5) a statement regarding creepage, (6) the accuracy as found and as left, carried out to tenths of a per cent, together with enough of the data taken at the time of the test to permit the convenient checking of the methods employed and the calculations.

(b) Each utility having more than 250 watthour meters in service shall make and annual tabulations of the results of all tests with the exception of initial tests and shop tests.

INDIANA.

RULE 8. *Record of meters and meter tests.*—(a) *Meter test record.*—Whenever any meter in service is tested, a record shall be preserved containing the information necessary for identifying the meter, the reason for making the test, the reading of the meter before the test and the result of the test, together with all data taken at the time of the test in sufficiently complete form to permit the convenient checking of the methods employed.

(b) *Meter record.*—A record shall also be kept, numerically arranged, giving for each meter owned or used by any utility, the date of purchase, its identification, and tests to which it has been subjected, with dates and general results of all tests. This record to apply to all meters purchased after the effective date of these rules and to all other meters in so far as the information is available.

(c) *Tabulation of meter tests.*—Annual tabulations of the results of all meter tests shall be made, arranged according to types of meters and intervals of test.

MARYLAND.

3. Whenever any service meter is tested the original test record shall be preserved, indicating the information necessary for identifying the meter, the reason for making the test, and, if removed, the reading of the meter upon removal from service and the result of the test, together with all data taken at the time of the test in sufficiently complete form to permit the convenient checking of the methods employed and the calculations.

4. A record shall also be kept, numerically arranged, indicating for each meter owned or used by any utility the date of purchase, a record of the use, repairs, and results of tests to which it has been subjected, and its present location.

MICHIGAN.

8. *Meters records.*—There shall be kept by each utility a numerically arranged and properly classified card record, giving for each meter owned or used by the utility for any purpose, the identification number, date of purchase, name of manufacturer, serial number, type, rating, and the name and address of each consumer on whose premises the meter has been in service, with date of installation and removal and class of service. This card record shall also give condensed information concerning all tests, adjustments, and repairs, including dates and general results of such tests, adjustments, and repairs.

9. Whenever any meter is tested there shall be made a separate detailed record of each test. This record shall contain all information necessary for identifying the meter, the reason for making the test, reading of dial before and after testing, conditions of accuracy before and after adjustment, and any other information and data which will permit a satisfactory and convenient checking of the test.

10. There shall also be made and preserved a periodical summary of all meter tests, arranged according to the make and type of meters, showing the number of meters within certain limits of accuracy, and the intervals between tests, and any other desirable information which can be conveniently summarized.

MISSOURI.

RULE 2. A record shall be kept, alphabetically arranged, of the names and addresses of all consumers furnished with metered service, with the identification number of meter or meters in use by each such consumer.

A record shall be kept, numerically arranged, in accordance with the utility's system of numbering its meters, indicating for each service meter owned or used a proper description, date of purchase (the approximate time of purchase if the exact date is not known), record of the use, repairs, adjustments, and tests to which the meter has been subjected, and its present location.

When a service meter is tested the original test record shall be preserved for a period of at least two years. This record shall include the information necessary for identifying the meter, date and place of test, name of person conducting the test, reason for making test, method of test, reading before being disturbed, statement regarding creepage if an electric meter, and the result of the test, together with all data taken at the time of the test so as to permit of the convenient checking of the methods employed and calculations in connection therewith.

NOTE.—Systems of meter and test records already in use will meet with the approval of the commission provided they conform substantially with the foregoing. Application shall be made to the commission for such approval.

MONTANA.

RULE 28. *Meter records.*—(a) A complete record shall be kept of all tests and inspections made under these rules as to the quality or conditions of service.

(b) Whenever any meter in service is tested a record shall be preserved containing the information necessary for identifying the meter; the reason for making the tests; the reading of the meter, both before and after the test; the result thereof, together with all data taken during the test in sufficiently complete form to permit the convenient checking of the methods employed.

(c) A record shall also be kept, numerically arranged, giving for each meter owned or used by any utility the date of purchase, its identification number and tests to which it has been subjected, with dates and general results of all tests. This record to apply to all meters purchased after the effective date of these rules and to all other meters in so far as the information is available.

(d) Annual tabulations of the results of all meter tests shall be made and arranged according to types of meters and intervals of tests.

NEVADA.

RULE 18. A complete record shall be kept of all tests made on electric meters.

NEW HAMPSHIRE.

RULE 10. Whenever an electric-service meter is tested, the original test record shall be kept indicating the information necessary for identifying the meter, the reasons for making the test, the reading of the meter before being disturbed, a statement regarding creepage, and the results of the test, together with all data taken. This record must be sufficiently complete to permit the convenient checking of the methods and the calculations. Each utility shall maintain a meter record, numerically arranged, indicating approximately when the meter was purchased, its identification, its various places of installment, with dates of installation and removal, and the dates and general results of all tests.

NEW JERSEY.

No. 17. (5) A complete record shall be kept of all complaint tests, office and periodic tests of watthour meters installed on consumers' premises. Such record shall include:

Owning utility's number.

Manufacturer's name and number.

Type, rated volts, amperes, and wire.

Date of each installation, removal, and test.

The average of the readings at full load, at light load, and at normal load as found at each and every test.

A record of tests of each meter shall be continuous for a period of not less than five years, and in any event of sufficient length to cover three consecutive periodic tests.

(See also "Reports and records," New Jersey, rule 24, p. 189.)

NEW YORK.

SECTION 5. A complete record shall be kept of all complaint, office and periodic tests of watthour meters installed on consumers' premises. Such records shall include:

Owning company's number.

Manufacturer's name and number.

Type, rated volts and amperes, and wire.

Date of each installation, removal and test.

Average of the readings at full load, at light load, and at normal load, as found at each and every test hereinafter prescribed.

SECTION 6. A record of tests of each meter shall be continuous for a period of not less than five years, and in any event of sufficient length to cover three consecutive periodic tests.

NORTH DAKOTA.

RULE 8. Record of meters and meter tests.—(a) *Meter test record.*—Whenever any meter in service is tested, a record shall be preserved containing the information necessary for identifying the meter, the reason for making the test, the reading of the meter before the test, and the result of the test, together with all data taken at the time of the test in sufficiently complete form to permit the convenient checking of the method employed.

(b) *Meter record.*—A record shall also be kept, numerically arranged, giving for each meter owned or used by any utility, the date of purchase, its identification, and tests to which it has been subjected, with dates and general results of all tests. This record to apply to all meters purchased after the effective date of these rules and to all other meters in so far as the information is available.

(c) *Tabulation of meter tests.*—Annual tabulations of the results of all meter tests shall be made, arranged according to types of meters and intervals of tests.

OKLAHOMA.

RULE 20. Meter records and reports.—(a) Each utility furnishing metered service shall keep a record:

- (1) Of the names and addresses of all its consumers with the utility's serial number of the meter or meters used by each of them.
- (2) Of all its meters, showing date of purchase, date of installation, removal and the final disposition thereof.

(b) A complete record shall be kept by each utility of all tests of watthour meters installed on consumers' premises. Such record shall include:

- (1) Owning utility's number of meter;
- (2) Manufacturer's name and number of meter;
- (3) Type and capacity of meter;
- (4) Constants of the meter;
- (5) Date and kind of test made;
- (6) The error (or per cent accuracy) at heavy load and at light load as found at each test;

(7) and the accuracy of adjustments as left after each test.

(c) The meter records and meter-test records of each utility shall be available for examination at any time by the commission, its engineers, and inspectors. The record of tests of each meter shall be continuous for at least two periodic test periods, and in no case for less than five years.

(d) Each utility shall report to the commission before July 1, 1922, the types and number of meters in its service, and yearly thereafter. Each utility shall file with the commission such reports of meter tests as the commission may from time to time require.

OREGON.

RULE 3. Records of tests and meters.—(a) A complete record of all tests of quality, service, or meter accuracy as made under these rules, shall be kept by each utility accessible to the public during business hours at the principal office in the town or city where the service is furnished, or at such other place as the commission may designate. The record shall contain complete information concerning each test, including the date and hour when the test was made, the name of the inspector conducting the test, the number of any meter tested and its capacity, the point at which pressure, voltage, or other tests were made when not made at the regular testing laboratory of the utility, the results of the tests, and such other data as may hereinafter in these rules be specifically required or as the commission may from time to time require, or as the utility making the test may deem desirable.

(b) Whenever any service meter is tested, the original test record shall be preserved, indicating the information necessary for identifying the meter, the reason for making the test, the reading of the meter before being disturbed, and the accuracy of measurement, together with all data taken at the time of the test, in sufficiently complete form to permit the convenient checking of the methods employed and the calculations.

(c) A record shall also be kept, numerically arranged, indicating approximately when each meter was purchased, its size, its identification, its various places of installation and removal, and the dates and general results of all tests.

PENNSYLVANIA.

RULE 13. *Meter records.*—Each utility shall maintain a record of all its service watt-hour meters, which record shall show the name of the manufacturer, the type, the rating, and the date of purchase. When purchased after July 1, 1914, the date and location of all installations in service and the removals therefrom, the date of all tests and the reasons therefor, and the error "as found" and "as left." This record shall be kept as specified in rule 10 and shall be complete and up to date within three years subsequent to July 1, 1914.

RULE 17. *Meters in service without test records.*—All watthour meters in service on and after July 1, 1914, for which there is no record of test within the time equal to the period of test for that class of meter as specified in rule 16 shall be tested as soon thereafter as circumstances will permit. In no case shall the time subsequent to July 1, 1914, exceed the length of the period of test for meters of that class and rating as specified in rule 16.

WASHINGTON.

RULE 6. A complete record of all the meter tests made under these rules shall be kept by each gas, electric, and water company, accessible to the public during business hours at its principal office in the town or city where the service is furnished or at such place as the commission may designate. The records so kept shall contain complete information concerning the result of each test, showing the date and hour upon which the test was made, the name of the inspector conducting the test, the capacity and number of the meter, and the percentage of accuracy obtained by the test, and such other data as the company may deem desirable.

WEST VIRGINIA.

RULE 17. *Meter records and reports.*—(a) Every utility furnishing metered service shall keep a record (1) of the names and addresses of all its consumers, with the utility's serial number of the meter or meters used by each of them, (2) of all its meters, showing date of installation and removal, name of manufacturer, serial number, type, meter constant, and transformer ratio.

(b) The meter records of every utility shall be available for examination at any time by the commission, its engineers, or inspectors. Every utility shall file with the commission such reports of meters tested as the commission may from time to time require.

(c) Every utility shall report to the commission on or before June 30, 1916, the types and number of every type of meters in its service, and yearly thereafter.

Whenever a utility places any new type in service, this type must be reported to the commission as soon as practicable.

WISCONSIN.

No. 18. *Meter test records.*—Whenever an electricity meter is tested the original test record shall be kept indicating the information necessary for identifying the meter, the reasons for making the test, the reading of the meter before being disturbed,

a statement regarding creepage and the accuracy of measurement, together with all data taken at the time of the test. This record must be sufficiently complete to permit the convenient checking of the methods and the calculations. All utilities having more than 250 electricity meters in service shall maintain a meter record, numerically arranged, indicating approximately when the meter was purchased, its identification, its various places of installation with dates of installation and removal, and the dates and general results of all tests, and shall tabulate the results of tests according to types of meters and intervals of test, compiled monthly and annually.

METER RENTALS.

ARIZONA.

RULE No. 20. No rental shall be charged by a utility supplying gas or electric current for any meter installed by it.

COLORADO.

RULE 11. *Meter rentals.*—(a) No meter rental, as distinguished from a minimum charge for service, shall be charged by any utility for any service meter installed by it for measurements upon which bills are rendered: *Provided, however,* That in cases where service meters are used as submeters to a main meter, a rental charge for such submeter may be established with the approval of this commission. The utility shall keep such submeters in good operating condition, but will not be required to keep a record of the monthly readings of these meters.

RULE 14. (a) All meters used in connection with metered service shall be furnished, installed, and maintained at the expense of the utility. Any appliance furnished at the expense of the utility shall remain its property and may be removed by it at any time after the discontinuance of service.

MARYLAND.

L 1. No meter rental, as distinguished from a minimum charge for service, shall be charged by any utility for any service meter installed by it for measurements upon which bills are rendered: *Provided, however,* That in cases where service meters are used as submeters to a main meter, a minimum charge for such submeter may be established, with the approval of the commission.

MONTANA.

RULE 19. *Meter rental.*—All meters and necessary connections shall be furnished and installed by and remain the property of the utility. No rental shall be charged for meters or other registering devices installed to measure the service rendered consumers.

NEW JERSEY.

No. 15. The utility shall without charge furnish each customer supplied with energy on a measured basis, with an electric meter and such service appliances as are customarily furnished by the utility in order to connect the customer's equipment with its mains.

NOTE.—Any utility now furnishing service through meters owned by customers must arrange to make over the same by January 1, 1915, and thereafter own and maintain all service meters.

OKLAHOMA.

RULE 35. *Service connection charges and meter rentals.*—No utility shall make any separate charge for furnishing any regular consumer with a service watt-hour meter

except as provided for by minimum charge or consumer's service charge. Where additional meters furnished by the utility are to be used as submeters or for the convenience of the consumer, a charge for such meters may be made in accordance with a schedule approved by the commission. If the reasonableness of any charge, rule, regulation, or practice of any utility with reference to service connections or extensions is challenged, the commission, will, upon complaint and investigation, prescribe the proper charge, rule, regulation, or practice, which shall thereafter be followed.

OREGON.

No. 8c. No rental shall be charged by any utility for any meter installed by it which is used by the utility as the basis for the rendering of bills.

WASHINGTON.

No. 11. No rental shall be charged by any company supplying gas, electric current, or water for any meter installed by it.

WEST VIRGINIA.

RULE 30. Service connections, charges, and meter rentals.—No utility shall make any charge for furnishing any consumer with a watthour meter and such service appliances as are customarily furnished by the utility in order to measure the service furnished to the consumer. In all cases the utility shall pay the cost of connecting its lines with meters. Any appliances furnished at the expense of the utility shall remain its property and may be removed by it at any time after the discontinuance of the service.

METERED SERVICE.

MICHIGAN.

35. *Use of meters.*—Watthour meters shall be placed in service for measuring the electrical energy used by every consumer (including the utility itself). The use or establishment of flat rates, except for signalling systems, street lighting, and similar applications, will not, in general, be approved by the commission.

36. *Meter readings.*—All watthour meters in service shall be read not less frequently than once in every three months, and an endeavor shall be made by the utility to always have meters read on corresponding days of each meter reading period.

MONTANA.

RULE 9. Free service.—No utility will be permitted to render free service or reduced rates other than provided for in the approved tariffs on file with the commission.

RULE 10. Unit of measurement.—(a) The unit of measurement for the purchase and sale of electrical energy shall be the kilowatthour. All electricity shall be sold within the State of Montana as measured by an approved type of watthour meter installed on the consumer's premises, except as follows:

(1) Meters will not be required for windows, outside decorative lighting, street lighting, or other constant loads at uniform hours where the consumption may be accurately computed without the use of measuring devices.

(2) Meters will not be required where electrical energy is sold under contract or maximum demand or some basis other than the kilowatthour, provided such contracts are approved by the commission.

(3) In case of current bought wholesale the meter may be installed at any point agreed upon by the parties interested.

(b) The utility will not be required to install a meter when not more than 120 watts are connected or on other services where, in the utility's judgment, the consumption will not exceed the minimum. All unmetered services shall be billed at the minimum.

(c) If more than one meter is installed, except where service conditions on a consumer's single premises make the installation of more than one meter necessary, each meter shall be considered by itself in calculating the amount of the bill. When more than one meter is installed under the exception noted above, the readings shall be added, and the bill computed as though the service were rendered through a single meter.

WEST VIRGINIA.

RULE 8. Methods of measuring service.—After January 1, 1916, no electricity shall be furnished and sold within the State of West Virginia except by metered service.

This does not apply to window, outside decorative lighting, street lighting, or transient consumers where the wiring furnishing such service is entirely separate from the wiring inside of buildings, used for general lighting purposes, and limited service as now furnished by the use of excess indicators or similar devices.

For good cause shown, the commission will allow exceptions to this rule in special cases. This rule shall not apply to persons or companies that, as an incident only to their main business, furnish electricity in small quantities to consumers.

PERIODIC TESTS OF METERS.

ARIZONA.

RULE No. 15. Each electric service meter shall be tested at least once in two years, the test to be made by comparing the meter with suitable standards on light-load, half-load, and full-load operation.

COLORADO.

RULE 37. Periodic tests.—(a) All types of watthour meters installed upon consumers' premises shall be periodically tested according to the following schedule:

Schedule for Periodic Testing of Watthour meters.

	Rated capacity of meter in amperes or kilovolt-amperes.	To be tested at least once in every—
Direct-current meters.....	Exceeding 500 amperes.....	12 months.
	500 amperes to 15 amperes.....	18 months.
	15 amperes and less.....	24 months.
Alternating-current meters:		
1. Single phase.....	Exceeding 25 amperes.....	24 months.
	25 amperes and less.....	36 months.
2. Polyphase.....	Exceeding 50 kilovolt-amperes.....	12 months.
	50 kilovolt-amperes and less.....	24 months.

(b) All watthour meters in service on and after January 1, 1917, for which there is no record on file at the utility's office of tests made within the period of time specified for that class and rating of meter shall be tested as soon as possible. In no case shall the time subsequent to such test exceed the period of test for meters of that class and rating as specified in this rule.

CONNECTICUT.

RULE E-17. Periodic tests.—(a) Each watthour meter shall be tested according to the following schedule while connected in its permanent position in place of service:

(1) Two and three wire commutating-type and mercury-type meters, not exceeding 50 amperes rated capacity of meter element, shall be tested at least once in every 18 months.

(2) Two and three wire commutating-type meters, exceeding 50 amperes rated capacity of meter element, shall be tested at least once in every 12 months.

(3) Two and three wire single-phase induction-type meters, not exceeding 25 amperes rated capacity of meter element, shall be tested at least once in every 36 months.

(4) Two and three wire single-phase induction-type meters, exceeding 25 amperes rated capacity of meter element, shall be tested at least once in every 24 months.

(5) Self-contained polyphase meters, not exceeding 50 kilovolt-amperes rated capacity, shall be tested at least once in every 18 months.

(6) Self-contained polyphase meters, exceeding 50 kilovolt-amperes rated capacity, shall be tested at least once in every 12 months.

(7) Polyphase meters connected with instrument transformers to circuits in which the connected load is not in excess of 50 kilovolt-amperes shall be tested at least once in every 24 months.

(8) Polyphase meters connected with instrument transformers to circuits in which the connected load exceeds 50 kilovolt-amperes shall be tested at least once in every 18 months.

(b) All watthour meters in service on and after November 1, 1915, for which there is on file at the utility's office no record of test made within the period of time specified for that class and rating of meter in paragraph (a) above, shall be tested as soon as possible. In no case shall the time subsequent to November 1, 1915, exceed the period of test for meters of that class and rating as specified in this rule.

DISTRICT OF COLUMBIA.

SECTION 7. *Periodic tests.*—All continuous-current commutator-type meters installed on consumers' premises shall be tested periodically as follows:

(a) Meters up to and including 50 amperes rated capacity, at least once in every 18 months.

(b) Over 50 amperes and including 150 amperes, at least once in every 12 months.

(c) Over 150 amperes, at least once in every 8 months.

All alternating-current induction-type meters shall be tested periodically as follows:

(d) Single phase meters up to and including 25 amperes rated capacity, at least once in every 36 months.

(e) Over 25 amperes, at least once in every 24 months.

(f) Polyphase meters up to and including 50 kilovolt-amperes rated capacity, at least once in every 24 months.

(g) Over 50 kilovolt-amperes rated capacity, at least once in every 12 months.

ILLINOIS.

RULE 14. *Periodic meter tests.*—Each watthour shall be inspected and tested according to the schedule below while connected in its permanent position on the consumers' premises. At the time a watthour meter is tested any demand meter associated with it shall be inspected or tested. Each demand meter shall be tested at least as often as the meter with which it is associated and as nearly as practicable at the same time.

Schedule of periodic tests on watthour meters.—(a) Two and three wire commutator-type and mercury-type meters, not exceeding 50 amperes rated capacity of meter element shall be tested at least once in every 18 months.

(b) Two and three wire commutator-type and mercury-type meters, exceeding 50 amperes rated capacity of meter element, shall be tested at least once in every 12 months.

(c) Two and three wire single phase induction-type meters not exceeding 25 amperes rated capacity of the meter element, which meet the requirements of the National Electric Light Association's Meter Code, shall be tested at least once in every 48 months. All other meters of this class and size shall be tested at least once in every

30 months. A list of the meters which meet the requirements of the National Electric Light Association's Code for Electricity Meters is as follows:

Maker.	Types.
General Electric Co.....	IS, IS-2, IS-3, IS-4, IP-2, IP-3, IP-4, I-8, I-10, I-14.
Westinghouse Electric & Manufacturing Co.....	B, C, OA.
Fort Wayne Electric Works.....	K, K-1, K-2, K-3, K-4, K-5.
Sangamo Electric Co.....	H.
Duncan.....	M-2.

(d) Two and three wire single-phase induction-type meters, exceeding 25 amperes rated capacity of meter element, shall be tested at least once in every 24 months.

(e) Self-contained polyphase meters, not exceeding 50 kilovolt-amperes rated capacity, shall be tested at least once in every 24 months.

(f) Self-contained polyphase meters, exceeding 50 kilovolt-amperes rated capacity, shall be tested at least once in every 12 months.

(g) Polyphase meters with instrument transformers and having not to exceed 50 kilovolt-amperes rated capacity, shall be tested at least once in every 24 months.

(h) Polyphase meters with instrument transformers and having capacities exceeding 50 kilovolt-amperes, shall be tested at least once in every 18 months.

Where instrument transformers are used the rated capacity of the meter is considered to be that of the complete metering installation and is determined by taking into consideration the ratio of the instrument transformers.

INDIANA.

RULE 15. Periodic tests of meters.—Each watthour meter shall be tested according to the following schedule while connected in its permanent position in place of service:

(a) Two and three wire commutating-type and mercury-type meters, up to and including 50 amperes rated capacity of meter element, shall be tested at least once every 18 months.

(b) Two and three wire commutating-type and mercury-type meters of over 50 amperes rated capacity of meter element, shall be tested at least once every 12 months.

(c) Two and three wire single-phase induction-type meters, up to and including 25 amperes rated capacity of meter elements shall be tested at least once every 36 months.

(d) Two and three wire single-phase induction-type meters of over 25 amperes rated capacity of meter element shall be tested at least once every 24 months.

(e) Self-contained polyphase meters, up to and including 50 kw. rated capacity, shall be tested at least once every 18 months.

(f) Self-contained polyphase meters of over 50 kw. rated capacity shall be tested at least once every 12 months.

(g) Polyphase meters, connected through current transformers or current and potential transformers, to circuits up to and including 50 kw. rated capacity, shall be tested at least once every 24 months.

(h) Polyphase meters, connected through current transformers, or current and potential transformers, to circuits of over 50 kw. rated capacity, shall be tested at least once every 18 months.

MARYLAND.

6. (a) Each utility furnishing metered service shall make periodic tests on consumers' premises as follows:

Induction-type meters at least every 36 months.

Commutating and all other type meters at least every 18 months.

In placing new or readjusted meters on a consumers' premises, after having fulfilled the test conditions set out in paragraph 4 (b), the meter shall be given an installation test as follows:

Induction-type meters, either before installation or within 30 days thereafter.
Commutating and all other type meters, within 60 days after installation.

Such installation test shall be coincident with and also constitute the first periodic test prescribed in the preceding paragraph; and this coincident test and subsequent periodic tests shall be made under the conditions prescribed in paragraph 4 (b): *Provided, however*, That if the meter is found more than 2 per cent in error in registration the test shall then be repeated under the conditions prescribed in paragraph 5 (c).

MICHIGAN.

31. *Periodic tests.*—Each watthour meter shall be tested according to the following schedule while connected in its permanent position in place of service:

(a) Two and three wire commutating-type and mercury-type meters, up to and including 50 amperes rated capacity or meter element, at least once every 18 months.

(b) Two and three wire commutating-type and mercury-type meters of over 50 amperes rated capacity of meter element, at least once every 12 months.

(c) Two and three wire single-phase induction-type meters, up to and including 25 amperes rated capacity of meter element, at least once every 36 months.

(d) Two and three wire single-phase induction-type meters of over 25 amperes rated capacity of meter element, at least once every 24 months.

(e) All polyphase induction-type meters, up to and including 150 amperes rated capacity of meter element, at least once every 24 months.

(f) All polyphase induction-type meters of over 150 amperes rated capacity of meter element, at least once every 12 months.

MISSOURI.

RULE 32. Unless otherwise ordered by the commission, each electric service watt-hour meter installed shall be periodically tested in accordance with the following schedule, or as much oftener as the results obtained may warrant, and adjusted in accordance with the provisions of rule 29.

(a) Induction-type meters having rated current capacities not exceeding 50 amperes, at least once every 24 months.

(b) Induction-type meters having rated current capacities exceeding 50 amperes, at least once in every 12 months.

(c) Commutator-type meters with rated current capacities not exceeding 50 amperes and voltage ratings not exceeding 250 volts, at least once every 12 months.

(d) All other meters at least once every 6 months.

In commutator-type meters having heavy moving elements and sapphire jewels, the number of revolutions of the moving element between tests should not ordinarily exceed 1,000,000.

MONTANA.

RULE 23. *Periodic tests.*—Each watthour meter shall be tested according to the following schedule while connected in its permanent position in place of service:

(a) Two and three wire commutating-type meters, up to and including 25 amperes rated capacity of meter element, shall be tested at least once every 24 months.

(b) Two and three wire commutating-type meters of over 25 amperes rated capacity of meter element shall be tested at least once every 18 months.

(c) Two and three wire single-phase induction-type meters up to and including 25 amperes rated capacity of meter elements shall be tested at least once every 36 months.

(d) Two and three wire single-phase induction-type meters of over 25 amperes rated capacity of meter element shall be tested at least once every 24 months.

(e) Self-contained polyphase meters up to and including 50 kw. rated capacity shall be tested at least once every 18 months.

(f) Self-contained polyphase meters of over 50 kw. rated capacity shall be tested at least once every 12 months.

(g) Polyphase meters, connected through current transformers or current and potential transformers, shall be tested at least once every 24 months.

NEVADA.

No. 17. Each electric service meter shall be tested at least once a year; the test to be made by comparing the meter while connected in its place of service with suitable standards, on normal operating loads and on 10 per cent of its rated capacity.

NEW HAMPSHIRE.

No. 4. Such electric service meter shall be tested according to the following schedule and adjusted to within 1 per cent at light load and heavy load. The tests shall be made, by comparing the meter, while connected in its permanent position, on the consumer's premises, when practicable, with suitable standards, making at least two test runs at each load of at least 30 seconds each, which agree within 1 per cent.

Single-phase induction-type meters having current capacities not exceeding 50 amperes, and polyphase induction-type meters having current capacities not exceeding 25 amperes, shall be tested at least once every 24 months, and as much oftener as the results shall warrant. During each period of 12 months, until all such meters have been tested, each utility shall test not less than 50 per cent of the meters now in service, those longest in service being tested first; provided, however, that this rule shall not require the testing of any meter within the period fixed by the above schedule after any prior test, if the utility shall have preserved a record of such prior test, and shall prior to September 1, 1914, file with the commission a statement giving the make, type, number, and size of the meter with the date and result of such prior test. All single-phase induction-type meters having current capacities exceeding 50 amperes, all polyphase induction-type meters having current capacities exceeding 25 amperes, and all commutator-type meters shall be tested at least once every 12 months, and as much oftener as results obtained shall warrant.

NEW JERSEY.

No. 17. (3) All direct-current meters installed upon consumers' premises shall be periodically tested according to the following schedule:

Meters up to and including 25 amperes rated capacity shall be tested at least once in every 18 months.

Meters exceeding 25 amperes, up to and including 500 amperes rated capacity, shall be tested at least once in every 12 months.

Meters exceeding 500 amperes rated capacity shall be tested at least once in every 6 months.

(4) All types of alternating-current induction meters shall be periodically tested as follows:

Single-phase meters up to and including 25 amperes rated capacity shall be tested at least once in every 30 months.

Single-phase meters exceeding 25 amperes rated capacity shall be tested at least once in every 24 months.

Polyphase meters up to and including 150 amperes rated capacity shall be tested at least once in every 24 months.

Polyphase meters exceeding 150 amperes rated capacity shall be tested at least once in every 12 months.

NEW YORK.

SECTION 8. All types of direct-current watthour meters installed upon consumers' premises shall be periodically tested in accordance with the following schedule:

(a) Meters up to and including 25 amperes rated capacity shall be tested at least once in every 30 months.

(b) Meters exceeding 25 amperes up to and including 200 amperes rated capacity shall be tested at least once in every 18 months.

(c) Meters exceeding 200 amperes up to and including 400 amperes rated capacity shall be tested at least once in every 12 months.

(d) Meters exceeding 400 amperes rated capacity shall be tested at least once in every 6 months.

SECTION 9. All types of alternating-current watthour meters installed upon consumers' premises shall be periodically tested in accordance with the following schedule:

(a) Single-phase meters up to and including 25 amperes rated capacity shall be tested at least once in every 42 months.

(b) Single-phase meters exceeding 25 amperes rated capacity shall be tested at least once in every 24 months.

(c) Polyphase meters up to and including 150 amperes rated capacity shall be tested at least once in every 24 months.

(d) Polyphase meters exceeding 150 amperes rated capacity shall be tested at least once in every 12 months.

(e) Single-phase or polyphase meters up to and including 100 kw. capacity, installed on circuits having a voltage of 2,000 volts and over, shall be tested at least once in every 12 months.

(f) Single-phase or polyphase meters exceeding 100 kw. capacity, installed on circuits having a voltage of 2,000 volts and over, shall be tested at least once in every 6 months.

NORTH DAKOTA.

• RULE 15. *Periodic tests of meters.*—Each watthour meter shall be tested according to the following schedule while connected in its permanent position in place of service:

(a) Two and three wire commutating-type and mercury-type meter, up to and including 50 amperes rated capacity of meter element, shall be tested at least once every 18 months.

(b) Two and three wire commutating-type and mercury-type meters of over 50 amperes rated capacity of meter element, shall be tested at least once every 12 months.

(c) Two and three wire single-phase induction-type meters up to and including 25 amperes rated capacity of meter elements shall be tested at least once every 36 months.

(d) Two and three wire single-phase induction-type meters of over 25 amperes rated capacity of meter elements, shall be tested at least once every 24 months.

(e) Self-contained polyphase meters up to and including 50 kw. rated capacity shall be tested at least once every 18 months.

(f) Self-contained polyphase meters of over 50 kw. rated capacity shall be tested at least once every 12 months.

(g) Polyphase meters, connected through current transformer or current and potential transformers, to circuits up to and including 50 kw. rated capacity, shall be tested at least once every 24 months.

(h) Polyphase meters, connected through current transformers or current and potential transformers, to circuits of over 50 kw. rated capacity, shall be tested at least once every 18 months.

OKLAHOMA.

RULE 17. *Periodic tests of watthour and demand meters.*—(a) All types of watthour and demand meters installed upon consumers' premises shall be periodically tested according to the schedule below, and in accordance with rules 13 and 14:

(1) Two and three wire commutator-type and mercury-type meters, not exceeding 50 amperes rated capacity of meter element, shall be tested at least once in every 18 months.

(2) Two and three wire commutator-type and mercury-type meters, exceeding 50 amperes rated capacity of meter element, shall be tested at least once in every 12 months.

(3) Two and three wire single-phase induction-type meters not exceeding 25 amperes rated capacity of the meter element, which meet the requirements of the National Electric Light Association's Meter Code, shall be tested at least once in every 48 months. All other meters of this class and size shall be tested at least once in every 30 months. A list of the meters which meet the requirements of the National Electric Light Association's Code for Electrical Meters is as follows:

Maker.	Types.
General Electric Co.....	IS, IS-2, IS-3, IS-4, IP-2, IP-3, IP-4, I-8, I-10, I-14.
Westinghouse Electric & Manufacturing Co.....	B, C, OA.
Fort Wayne Electric Works.....	K, K-1, K-2, K-3, K-4, K-5.
Sangamo Electric Co.....	H.
Duncan.....	M-2.

(4) Two and three wire single-phase induction-type meters, exceeding 25 amperes rated capacity of meter element, shall be tested at least once in every 24 months.

(5) Self-contained polyphase meters, not exceeding 50 kilovolt-amperes rated capacity, shall be tested at least once in every 24 months.

(6) Self-contained polyphase meters, exceeding 50 kilovolt-amperes rated capacity, shall be tested at least once in every 12 months.

(7) Polyphase meters with instrument transformers and having not to exceed 50 kilovolt-amperes rated capacity, shall be tested at least once in every 24 months.

(8) Polyphase meters with instrument transformers and having capacities exceeding 50 kilovolt-amperes, shall be tested at least once in every 18 months.

(9) Direct-current meters, not exceeding 50 amperes rated capacity shall be tested at least once every 24 months.

(10) Direct-current meters, exceeding 50, but not exceeding 500 amperes rated capacity, shall be tested at least once every 18 months.

(11) Direct-current meters, exceeding 500 amperes rated capacity shall be tested at least once in every 6 months.

(b) Where instrument transformers are used the rated capacity of the meter is considered to be that of the complete metering installation and is determined by taking into consideration the ratio of the instrument transformers.

(c) All watthour and demand meters in service on and after July 1, 1922, for which there is on file at the utility's office no record of test made within the period of time specified for that class and rating of meter in above paragraphs (1) to (11), inclusive, shall be tested as soon as possible. In no case shall the time subsequent to July 1, 1922, exceed the period of test for meters of that class and rating, as specified in this rule. Demand meters associated with or used in connection with watthour meters shall be tested at the same time the watthour meters are tested.

OREGON.

No. 22. (a) Each watthour meter shall be tested according to the following schedule and shall be adjusted whenever it is found to be in error more than 1 per cent, the tests both before and after adjustment being made at approximately three-quarters and one-tenth of the rated capacity of the meter. The tests shall be made by comparing the meter, while connected in its permanent position in the premises of the customer, with approved suitable standards, making at least two test runs at each load, of at least 30 seconds each, which agree within 1 per cent.

(b) Single-phase, induction-type meters, having current capacities not exceeding 50 amperes, shall be tested at least once every three years, and as much oftener as the results obtained shall warrant.

(c) Single-phase, induction-type meters, having current capacities exceeding 50 amperes, all polyphase meters having voltage ratings not exceeding 550 volts and current capacities not exceeding 50 amperes, and all commutator meters having voltage ratings not exceeding 550 volts and current capacities not exceeding 50 amperes, shall be tested at least once every 12 months.

(d) All other watthour meters shall be tested at least once every 6 months.

PENNSYLVANIA.

No. 16. *Frequency of periodic tests.*—Each utility shall make periodic tests of all its watthour meters in service, in accordance with the following schedule:

(a) Two and three wire commutating-type and mercury-type meters, up to and including 50 amperes rated capacity of meter element, shall be tested at least once every 18 months.

(b) Two and three wire commutating-type and mercury-type meters of over 50 amperes rated capacity of meter element shall be tested at least once every 12 months.

(c) Two and three wire single-phase, induction-type meters, up to and including 25 amperes rated capacity of meter element, and manufactured prior to January 1, 1907, shall be tested at least once every 30 months. Meters of the same type and rating manufactured since January 1, 1907, shall be tested at least once every 36 months.

(d) Two and three wire single-phase, induction-type meters of over 25 amperes rated capacity of meter element shall be tested at least once every 24 months.

(e) Self-contained polyphase meters, up to and including 50 kw. rated capacity, shall be tested at least once every 18 months.

(f) Self-contained polyphase meters of over 50 kw. rated capacity shall be tested at least once every 12 months.

(g) Polyphase meters, connected through current transformers or current and potential transformers, to circuits up to and including 50 kw. rated capacity, shall be tested at least once every 24 months.

(h) Polyphase meters, connected through current transformers, or current and potential transformers to circuits of over 50 kw. rated capacity, shall be tested at least once in every 18 months.

Whenever the number of meters of any type which registers in error beyond the limits specified in rule 11 is deemed by the commission to be excessive, then this type shall be tested with such additional frequency as the commission may direct.

SOUTH CAROLINA.

RULE 16. *Periodic tests of meters.*—Each watthour meter shall be tested according to the following schedule, while connected, if practical, in its permanent position in place of service:

(a) Two and three wire commutating type and mercury type meters up to and including 50 amperes rated capacity of meter element shall be tested at least once every 18 months.

(b) Two and three wire commutating type and mercury type meters of over 50 amperes rated capacity of meter element, shall be tested at least once every 12 months.

(c) Two and three wire single phase induction type meters, up to and including 25 amperes rated capacity of meter element, shall be tested at least once every 36 months.

(d) Two and three wire single phase induction type meters of over 25 amperes rated capacity of meter element, shall be tested at least every 24 months.

(e) Self-contained polyphase meters, up to and including 50 kw. rated capacity, shall be tested at least once every 18 months.

(f) Self-contained polyphase meters of over 50 kw. rated capacity shall be tested at least once every 12 months.

(g) Polyphase meters, connected through current transformers or current and potential transformers to circuits up to and including 50 kw. rated capacity, shall be tested at least once every 24 months.

(h) Polyphase meters, connected through current transformers or current and potential transformers to circuits of over 50 kw. rated capacity, shall be tested at least once every 18 months.

WASHINGTON.

RULE 25. Each electric service meter shall be tested at least once every two years by the company furnishing the service; the test to be made by comparing the meter with suitable standards, on one-tenth load and full-load rate of operation.

WEST VIRGINIA.

RULE 14. *Periodic tests.*—(a) All types of direct-current watthour meters installed upon consumer's premises shall be periodically tested according to the following schedule:

1. Meters up to and including 25 amperes rated capacity, shall be tested at least once in every 18 months.

2. Meters exceeding 25 amperes, up to and including 500 amperes, rated capacity, shall be tested at least once in every 12 months.

3. Meters exceeding 500 amperes rated capacity, shall be tested at least once in every 6 months.

(b) All types of alternating current induction watthour meters installed upon consumer's premises shall be periodically tested as follows:

1. Single-phase meters, up to and including 25 amperes rated capacity, shall be tested at least once in every 36 months.

2. Single-phase meters, exceeding 25 amperes rated capacity, shall be tested at least once in every 24 months.

3. Polyphase meters, up to and including 50 kw. rated capacity, shall be tested at least once in every 24 months.

4. Polyphase meters, exceeding 50 kw. rated capacity, shall be tested at least once in every 12 months.

(c) All watthour meters in service on and after January 1, 1915, for which there is on file at the utility's office no record of test made within the period of time specified for that class and rating of meter in (a) and (b) above shall be tested as soon as possible. In no case shall the time subsequent to January 1, 1915, exceed the period of test for meters of that class and rating as specified in this rule. For good cause shown, the commission will allow exceptions to this rule in special cases. Where meters are found to register considerably in error when tested on the above schedules, the commission reserves the right to order more frequent tests for that particular class of meters for that particular utility.

WISCONSIN.

NO. 17. *Periodic tests.*—Each watthour meter shall be tested according to the following schedule and adjusted whenever it is found to be in error more than 1 per cent, the tests both before and after adjustment being made at approximately three-quarters and one-tenth of the rated capacity of the meter. Meters operated at low power factor shall also be tested at approximately the minimum power factor under which they will be required to operate. The tests shall be made by comparing the meter, when connected in its permanent position, on the consumer's premises, with approved, suitable standards, making at least two test runs at each load of at least 30 seconds each, which agree within 1 per cent.

Single-phase, induction-type meters having current capacities not exceeding 50 amperes and which meet the requirements of the National Electric Light Association's Meter Code shall be tested at least every 48 months; all other types shall be tested every 24 months.

All single-phase induction-type meters having current capacities exceeding 50 amperes and all polyphase and commutator type and such mercury flotation types as are listed below unless voltage rating of any of these types exceeds 250 volts or current capacity exceeds 50 amperes, shall be tested at least every 12 months.

All other watthour meters shall be tested at least once every 6 months.

In no case shall commutator-type meters having heavy moving elements and sapphire jewels be allowed to make more than 1,000,000 revolutions between tests. Where meters are found to register considerably in error when tested on the above schedule the commission reserves the right to order the particular meter or class of meters tested more frequently.

A list of the meters which meet the requirements of the National Electric Light Association's "Code for Electricity Meters" referred to in the modified order is as follows:

Maker.	Types.
General Electric Co.....	IS, IS-2, IS-3, IP, IP-2, IP-3, I, I-8, I-10, Form D F-2, I-14.
Westinghouse Electric & Manufacturing Co.....	B, C, OA.
Fort Wayne Electric Works.....	K, K-1, K-2, K-3, K-4, K-5.
Sangamo Electric Co.....	H.
Duncan.....	M-2.

The following types of mercury flotation meters are accepted:

Maker.	Types.
Sangamo Electric Co.....	D-5.

POLE IDENTIFICATION AND INSPECTION.

COLORADO.

RULE 28. Pole identification.—(a) In the case of two or more utilities jointly owning or using a pole or pole-line structure, each of these utilities shall mark each such pole or structure with the initials of its name, abbreviation of its name, corporate symbol, or other distinguishing mark by which the ownership of such structure may be readily and definitely determined.

(b) Each utility shall in the future mark each such pole, post, or other structure used for supporting electrical conductors with "dating nails" or other approved devices which will indicate the year in which such structures were installed. It is suggested that a different type of dating nail be used for new poles or structures and for poles reused. All poles or structures known to have been installed or replaced during the preceding year shall likewise be so marked.

(c) The requirements herein shall apply to all existing and future erected structures, and to all changes in ownership.

RULE 29. Pole inspection.—Each pole, post, tower, or other structure used for the support or attachment of electrical conductors, guys, or lamps must be inspected by the utility owning or using it with sufficient frequency to determine the necessity for replacement or repair.

CONNECTICUT.

RULE E-3. Pole identification.—(a) Each utility owning or having the custody and maintenance of a pole, post, or other structure used for supporting electrical conductors shall, on or before October 1, 1916, mark each such pole, post, or other

structure with a designating mark or symbol indicating the utility so owning or having the custody and maintenance thereof, and a number by which the location of each such pole or other structure may be described: *Provided, however,* That such utilities will not be required to mark more than every fifth pole upon a through or trunk line of poles in a rural district; and *Provided, further,* That the mark of no utility other than the one owning or having the custody and maintenance shall be required on jointly used poles.

(b) Each such utility shall mark in similar manner all such structures subsequently erected or coming under its ownership or control.

(c) Each such company shall within 30 days from date hereof submit for the approval of the commission its proposed method of complying with the provisions of paragraph (a) hereof.

INDIANA.

RULE 28. *Pole identification.*—(a) Each utility shall, on or before January 1, 1919, mark each pole, post, or other structure used for supporting electrical conductors with (1) the initials of its name, abbreviation of its name, corporate symbol, or other distinguishing mark by which the owner of each such structure may be readily and definitely determined; (2) a number by which the location of each such structure may be described.

(b) The identification marks shall be made with paint, stamps, brands or other means as the utility may elect to use, and the characters of the mark shall be of such size and so spaced and hereafter maintained as to be easily read by one standing on the ground at a distance of 6 feet from the structure.

(c) In the case of two or more utilities jointly owning any such structure, the distinguishing mark of each utility shall be placed thereon, but not more than one number need necessarily be placed thereon.

(d) In case of such structures erected upon private rights of way, or on the public highways, when of such character that the construction may be deemed to be a through line, such marks and numbers need be affixed only to every fifth structure.

(e) The requirements herein shall apply to all existing and future erected structures and to all changes in ownership.

(f) Every utility shall file with the commission in duplicate on or before January 1, 1919, a statement showing (1) the initials, abbreviation of name, corporate symbol, or distinguishing mark; (2) the manner of marking to be employed; (3) the method intended to be followed in numbering structures within the limits of cities, towns or other built-up communities, and upon through lines.

NEW JERSEY.

4. *Pole identification.*—(a) Each utility owning poles supporting wires along or over public highways, this to include each railroad, street railway, telephone, telegraph, and electric light and power utility, shall, on or before January 1, 1915, stencil each pole, post, or other structure similarly used with—

(1) The initials of its name, abbreviation of its name, corporate symbol, or other distinguishing mark by which the owner of each such structure may be readily and definitely determined.

(2) A number by which the location of each such structure may be described.

(b) The manner of making such stencils shall be with paint, and the characters of the stencil shall be of such size and so spaced and hereafter maintained as to be easily read from the surface of the ground at a distance of 10 feet from the structure.

(c) In the case of two or more utilities jointly owning any such structure the distinguishing mark of each utility shall be placed on such structure, but not more than one number necessarily shall be placed thereon.

(d) In the case of such structures carrying or supporting overhead trolley wires where there is a double line of structures, one on each side of the railroad track, such stencil need be affixed to but one line of such structures.

(e) In the case of such structures erected upon private rights of way or on the public highways of such character that the construction may be deemed to be a through or trunk line, such stencil need be affixed only to every fifth structure: *Provided, however,* That each and every structure situated within the limits of any built-up community shall be stenciled, except as otherwise provided in paragraph (d).

(f) The requirements herein shall apply to all existing and future erected structures and to all changes in ownership.

(g) Every such utility shall file with the board of public utility commissioners, in duplicate, on or before March 1, 1914, a statement showing—

(1) The initials, abbreviation of name, corporate symbol, or distinguishing mark.

(2) The means of stenciling to be employed.

(3) The method intended to be followed in numbering structures, to wit, within the limits of cities, towns, or other built-up communities, and upon through or trunk lines.

5. *Pole inspection.*—Each pole, post, tower, or other structure used for the support or attachment of wires, guys, or lamps must be inspected by the utility owning or using it with sufficient frequency and comprehensiveness to determine in each specific case the necessity for replacement or repair.

The inspector shall be guided by the specifications referred to in article 3 of these rules, and also for the guidance of the inspector reference is hereby made to the general rules for pole replacement inspection of the American Telephone & Telegraph Co.

NEW YORK.

Second District.

CASE NO. 2499. *Ordered:* 1. That each and every electrical corporation, municipality, telephone corporation, telegraph corporation, railroad corporation, and street railroad corporation owning poles, towers, or frames hereinafter termed "structures," in streets, highways, or public places, or on private rights of way, for supporting and carrying overhead electric wire systems for the transmission or distribution of electric energy for light, heat, or power, or for the operation of electric cars or trains, or for telephoning or telegraphing, or for supporting electric lamps or fixtures, shall on or before January 1, 1913, stencil each such structure, except as hereinafter provided, as follows: to wit, (a) with the initials of its name, abbreviation of its name, corporate symbol, or other distinguishing mark by which the owner of each such structure readily and definitely may be determined; (b) with a number by which the location of each such structure may be described.

Ordered: 2. That the manner of making such stencils shall be preferably with paint, otherwise with metal tags, badges, or stamps as each such corporation may elect to use; and that the characters of the stencil shall be of such size and so spaced and hereafter maintained as to be easily read from the surface of the ground at a distance of 6 feet from the structure.

Ordered: 3. That in case of two or more companies jointly owning any such structure, the distinguishing mark of each company shall be placed on such structure, but not more than one number necessarily shall be placed thereon.

Ordered: 4. That in the case of such structures carrying or supporting overhead trolley wires where there is a double line of structures, one on each side of the railroad track, such stencil need be affixed to but one line of such structures.

Ordered: 5. That in the case of such structures erected upon private rights of way or on the public highways of such character that the construction may be deemed to be a through or trunk line, such stencil need be affixed only to every fifth structure: *Provided, however,* That each and every such structure situate within the limits of

any city, village, or hamlet shall be stenciled, except as otherwise provided in paragraph 4 herein. Where every fifth structure is stenciled, the commission suggests that the number of the mile from the starting point of the construction be placed on the structure stenciled, and also the number of every fifth structure within that mile. And the commission further suggests that all such structures situate within the limits of every city, village, and hamlet shall be numbered consecutively along each street, avenue, or highway for the distance upon which structures are located.

Ordered: 6. That the requirements herein shall apply to all existing and future constructed structures and to all changes in the ownership of structures.

Ordered: 7. That every such corporation shall file with this commission on or before May 1, 1912, a statement showing—

(a) The initials, abbreviation of name, corporate symbol, or other distinguishing mark, intended to be used;

(b) The means of stenciling to be employed, to wit, paint, metal tags, badges, or stamps;

(c) The method intended to be followed in numbering structures, to wit, within the limits of cities, villages, and hamlets; and upon through or trunk lines.

NORTH DAKOTA.

RULE 28. Pole identifications.—(a) Each utility shall, on or before January 1, 1921, mark each pole, post, or other structure used for supporting electrical conductors with (1) the initials of its name, abbreviation of its name, corporate symbol, or other distinguishing mark by which the owner of each such structure may be readily and definitely determined.

(b) The identification marks shall be made with paint, stamps, brands, or other means as the utility may elect to use, and the characters of the mark shall be of such size and so spaced and hereafter maintained as to be easily read by one standing on the ground at a distance of 6 feet from the structure.

(c) In the case of two or more utilities jointly owning any such structure, the distinguishing mark of each utility shall be placed thereon but not more than one number need necessarily be placed thereon.

(d) In case of such structures erected upon private rights of way, or on the public highways, when of such character that the construction may be deemed to be a through line, such marks and numbers need be affixed only to every fifth structure.

(e) The requirements herein shall apply to all existing and future erected structures and to all changes in ownership.

(f) Every utility shall file with the commission in duplicate on or before January 1, 1921, a statement showing (1) the initials, abbreviation of name, corporate symbol or distinguishing mark; (2) the manner of marking to be employed.

OKLAHOMA.

RULE 8. Pole identification.—(a) Each utility shall, on or before January 1, 1923, mark each pole, post, or other structure used for supporting electrical conductors with—

(1) The initials of its name, abbreviation of its name, corporate symbol, or other distinguishing mark by which the owner of each such structure may be readily and definitely determined.

(2) A number by which the location of each such structure may be described.

(b) The identification marks shall be made with paint, stamps, brands, or other means as the utility may elect to use, and the characters of the mark shall be of such size and so spaced and hereafter maintained as to be easily read by one standing on the ground at a distance of 6 feet from the structure.

(c) In the case of two or more utilities jointly owning any such structure, the distinguishing mark of each utility shall be placed thereon, but not more than one number need necessarily be placed thereon.

(d) In the case of such structures erected upon private right of way, or on the public highways, when of such character that the construction may be deemed to be a through line, such marks and numbers need be affixed only to every fifth structure.

(e) The requirements herein shall apply to all existing and future erected structures and to all changes in ownership.

(f) Every such utility shall file with the commission in duplicate on or before February 1, 1922, as required in commission's order No. 1946, a statement showing:

(1) The initials, abbreviation of name, corporate symbol, or distinguishing mark.

(2) The means of marking to be employed.

(3) The method intended to be followed in numbering structures within the limits of cities, towns, or other built-up communities, and upon through lines.

RULE 9. Pole inspection.—Each pole, post, tower, or other structure used for the support or attachment of electrical conductors, guys, or lamps must be inspected by the utility owning or using it with sufficient frequency to determine the necessity for replacement or repair.

WEST VIRGINIA.

RULE 5. Pole identification.—(a) Every utility owning poles, posts, or other structures, supporting wires, shall on or before June 1, 1916, mark every such structure when located within a built-up community with—

(1) The initials or abbreviation of its name, corporate symbol, or other distinguishing mark by which the owner of every such structure may be readily determined.

(2) The number by which the location of every such structure may be described.

(b) When such structure is located outside of a built-up community, only every fifth structure shall be so marked and numbered.

(c) Such marks shall be made with paint, stamps, or brands, as the utility may elect to use, and the characters of the mark shall be of such size and so spaced and hereafter maintained as to be easily read from the surface of the ground at a distance of 6 feet from the structure.

(d) In the case of two or more utilities jointly owning any such structure, the distinguishing mark of every utility shall be placed on such structure, but not more than one number necessarily shall be placed thereon.

(e) In the case of such structures carrying or supporting overhead trolley wires where there is a double line of structures, one on each side of the railroad track, such marks need be affixed to but one line of such structures.

(f) In the case of such structures erected upon private rights of way or on the public highways of such character that the construction may be deemed to be a through or trunk line, such marks need be affixed only to every fifth structure: *Provided, however,* That every such structure situated within the limits of any built-up community shall be marked, except as otherwise provided in paragraph (e).

(g) The requirements herein shall apply to all existing structures and those hereafter erected, and to all changes in ownership.

(h) Every such utility shall file with the commission in duplicate on or before October 1, 1915, a statement showing:

1. The initials, abbreviation of name, corporate symbol, or distinguishing mark.

2. The means of marking to be employed.

3. The method intended to be followed in numbering structures (1) within the limits of cities, towns, or other built-up communities, and (2) outside of such communities.

RULE 6. Pole inspection.—Every pole, post, tower, or other structure used for the support or attachments of wires, guys, or lamps, must be inspected by the utility owning or using it with sufficient frequency to determine the necessity for replacement or repair.

The inspector should be guided by the specifications referred to in rule 4.

REFEREE OR COMMISSION TESTS—FEES.

COLORADO.

RULE 39. Tests by commission.—(a) Any service watthour meter will be tested by an employee of the commission upon written application by the consumer. For such test a fee shall be forwarded to the commission by the party making application for the test, which fee shall be refunded to the consumer by the utility if the meter be found fast beyond the limits prescribed in rule 40. The schedule of fees for commission tests of watthour meters is as follows:

- | | |
|---|--------|
| (1) For continuous-current and single-phase meters operating on 600 volts or less, up to and including 25 amperes rated capacity of the meter element, each..... | \$2.00 |
| (2) For each additional 50 amperes or fraction thereof..... | .50 |
| (3) For single-phase meters above 600 volts and for polyphase meters with or without instrument transformers up to and including 25 kilowatts rated capacity..... | 3.00 |
| (4) For each additional 25 kw. rated capacity or fraction thereof..... | 3.00 |

(b) Upon written application to the commission by any electric utility, the commission will make a test on any of the utility's service meters upon payment of the scheduled fee.

CONNECTICUT.

RULE 5. Tests of meters by request of customers.—(b) Section 20, chapter 128, public acts of 1911, provides that—

"Upon petition of any person, and the payment by such person of a fee of \$1 for each meter, the commission shall cause to be inspected any electric, gas, or water meter used in measuring electricity, gas, or water supplied to such petitioner. The company supplying electricity, gas, or water through such meter shall reimburse the petitioner for said fee if such meter be found to be more than 2 per cent fast in the case of a gas meter, or 4 per cent fast in the case of an electric or water meter, and shall not again use such meter until corrected and approved by the commission. The commission shall cause to be approved every electric, gas, or water meter in which the error does not exceed 2 per cent for gas meters or 4 per cent for electric or water meters, and shall cause the same to be stamped with some suitable device and the date of approval."

(c) After notification by the commission of the test impending under the provisions of the preceding paragraph (b) the utility shall neither adjust, disturb, nor remove the meter in question, except as directed by the authorized representative of the commission.

(d) For the purpose of rule 5 (b) the commission will be inclined to determine the average error of a meter by taking one-fifth of the sum of (1) the error at approximately full-rated or maximum capacity, (2) the error at light load or rate, (3) three times the error at normal or nominal rated capacity.

DISTRICT OF COLUMBIA.

SECTION 10. Referee tests.—Upon application of any consumer to the Electrical Inspection Bureau, a test shall be made of the consumer's meter by the bureau after deposit by the consumer of the prescribed fee. If, upon test, the meter is found to have an error in registration not in excess of 4 per cent or to read slow, the fee deposited by the consumer at the time of making application for the test will be kept. If, upon test, the meter is found to read fast in excess of 4 per cent on any of the three loads prescribed herein, the fee deposited by the consumer will be returned and the prescribed fee shall be paid by the electrical corporation owning the meter.

SECTION 11. Upon application of an electrical corporation to the Electrical Inspection Bureau, a meter shall be tested by the bureau and the prescribed fee shall be paid therefor by the said corporation.

SECTION 12. *Fees and records.*—The prescribed fees for referee tests of meters shall be as follows: One dollar for each meter not exceeding 50 amperes rated capacity; \$2 for each meter of greater capacity.

SECTION 13. The Electrical Inspection Bureau shall keep a complete record of each test of a meter made by it and of all fees due and received for such testing. All such fees shall be paid by the bureau to the collector of taxes of the District of Columbia for payment into the Treasury of the United States to be placed to the credit of the United States and the District of Columbia in equal parts.

ILLINOIS.

RULE 16. *Referee test.*—(a) Upon written application by any consumer to the commission a test will be made of the consumer's watthour meter by a representative of the commission. For such a test a fee as scheduled below shall be forwarded to the commission with the application, which fee shall be refunded to the applicant by the utility if the meter be found more than 4 per cent fast, the average error of the meter being calculated as specified in rule No. 9a.

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|---|--------|
| (1) For direct-current or single-phase watthour meters operating on circuits of 650 volts or less, and having not to exceed 25 amperes rated capacity.... | \$2.00 |
| (2) For each additional 50 amperes or fraction thereof..... | .50 |
| (3) For single-phase meters operating on circuits of more than 650 volts, and for polyphase meters, with or without instrument transformers, having not to exceed 25 kilovolt-amperes rated capacity..... | 3.00 |
| (4) For each additional 25 kilovolt-amperes of rated capacity..... | .50 |

Where instrument transformers are used the rated capacity of the meter is considered to be that of the complete metering installation and is determined by taking into consideration the ratio of the instrument transformers.

(b) Any demand meter will be tested by a representative of the commission upon written application by the consumer and receipt of a fee of \$2. This fee shall be refunded to the applicant by the utility if the indicator be found to overregister more than 4 per cent.

(c) The meter shall in no way be disturbed after the utility or its representative has received notice that application has been made for a referee test, unless authority to do so is first given in writing by the commission or by the consumer.

INDIANA.

RULE 17. *Tests upon application to commission.*—(a) Upon formal application of any consumer to the commission, a test will be made upon the consumer's meter by an inspector employed by the commission, such test to be made as soon as practicable after the receipt of the application. For such test a fee of \$2 shall be paid by the consumer making application for the test; if the meter is found to be slow or correct within the allowable limit, but by the company owning the meter if the meter is found to be fast beyond the allowable limit.

(b) Upon formal application of any consumer to the commission an electric demand test will be made upon the consumer's electric load, by an inspector employed by the commission, such test to be made as soon as practicable after receipt of the application and under exactly similar conditions of installation and operation as may be mutually agreed upon, in writing, by the consumer and the utility. For such test a fee of \$10 shall be paid by the consumer making the application for the test. If the electric demand is found to be higher than the demand fixed by the utility,

or correct, said fee is to be retained by the commission, but if the electric demand shall be found to be less than the demand fixed by the utility, then the \$10 paid by the consumer shall be returned to said consumer and the same amount shall be collected of the utility.

MARYLAND.

5. (b) Upon formal application by a consumer to the commission a test will be made of the consumer's meter as soon as practicable by an inspector of the commission. The application for such test shall be accompanied by a deposit of \$1. If the meter is found to be more than 4 per cent fast the deposit will be returned to the consumer by the commission and the amount thereof shall be paid to the commission by the utility. If the meter is found to be 4 per cent or less fast the deposit will be retained and disposed of according to law.

(c) The test shall be made at light, normal, and full loads under conditions prescribed in rule 4 (b) with the addition of the test at normal load below outlined and the meter accuracy shall be determined as follows: The average of these tests, obtained by multiplying the average result of the test at normal load by three, adding the average result of the tests at light load and at full load, and dividing the total by five, shall be deemed the condition of the meter. A meter so tested shall be deemed an illegal meter if the error is more than 4 per cent to the prejudice of the consumer. The following classification, in percentage of connected load, shall be used in determining the normal load, unless the demand has been actually measured:

CLASSIFICATION OF INSTALLATION TO BE USED IN TESTING METERS AT NORMAL LOAD.

	Per cent.
A. Residence and apartment lighting.....	25
B. Elevator Service.....	40
C. Factories (individual drive), churches, and offices.....	45
D. Factories (shaft drive), theaters, clubs, entrances, hallways, and general store lighting.....	60
E. Saloons, restaurants, pumps, air compressors, ice machines, and moving-picture theaters.....	70
F. Sign and window lighting and blowers.....	100

MICHIGAN.

33. *Energy consumption tests.*—Upon formal application of any consumer to the commission, a test will be made upon the consumer's meter by an inspector employed by the commission for the purpose of determining the accuracy of measurement of the energy consumed, such test to be made as soon as practicable after the receipt of the application. For such test a fee of \$5 shall be paid by the consumer making application for the test, and if the meter is found to be slow or correct within the allowable limits then the amount deposited shall be retained by the commission, but if the meter is found to be fast beyond the allowable limits then the fee paid by the consumer shall be returned to said consumer and the same amount shall be collected from the utility.

34. *Demand tests.*—Upon formal application of any consumer to the commission a demand test will be made upon the consumer's load by an inspector employed by the commission, such test to be made as soon as practicable after the receipt of the application. For such test a fee of \$10 shall be paid by the consumer making application for the test, and if the demand is found to be equal to or higher than the demand fixed by the utility then the amount deposited shall be retained by the commission, but if the demand is found to be less than the demand fixed by the utility then the fee paid by the consumer shall be returned to said consumer and the same amount shall be collected from the utility.

MISSOURI.

RULE 34. Any electric service meter will be tested at the laboratories of the School of Engineering of the State University at Columbia, Mo., upon written application to the dean of the School of Engineering for such test.

Meter to be tested must be removed and packed by or with the consent of the utility furnishing electric service, but the consumer shall be given an opportunity to witness the disconnection, packing, and shipment of same should he so desire.

The meter will be returned from the engineering laboratories with a special seal which, if the meter is to be again installed on this consumer's premises, shall not be disturbed until after the consumer has been given an opportunity to inspect same.

A test fee of \$2 will be charged for each single-phase or direct-current watthour meter having a current capacity not exceeding 25 amperes and without instrument transformers. For other meters a proportionally larger fee will be charged, depending upon the type and size of the meter.

If the meter is fast beyond the prescribed limit in rule 31, the utility will be required to pay the test fee and cost of shipping meter. Otherwise these expenses shall be borne by the consumer requesting the test.

MONTANA.

25. (b) If a consumer is dissatisfied with a test made by the utility, and makes a written application to the Public Service Commission, a test will be made by the commission as soon as practicable after receipt of the application. For such test a fee of \$2 shall be paid by the consumer at the time of his request; if the meter is found to be fast beyond the allowable limit, the fee will be refunded to the complainant and the amount collected from the utility. If the meter is found to be slow or correct within the allowable limit, the fee paid by the consumer will be retained by the commission.

NEVADA.

RULE 21. Upon formal application of any consumer to the Public Service Commission a test shall be made upon the consumer's meter by an inspector, employed by the commission, such test to be made as soon as practicable after the receipt of the application. For such a test a fee of \$1.50 shall be paid by the consumer making application for the test if the meter is found to be slow or correct within the allowable limit, and by the company owning the meter if the meter is found to be fast beyond the allowable limit.

NEW HAMPSHIRE.

RULE 6. Any electric service meter may be tested by an inspector employed by the commission, upon written application of the consumer, and payment of the cost of inspection to the commission. If the meter is found to be more than 4 per cent fast the amount paid by the consumer will be returned to him and shall then be paid by the utility. Each such application shall be accompanied by a fee of \$1, which is fixed as the fee for testing upon complaint any meter with a voltage rating not exceeding 250 volts, and a current capacity not exceeding 25 amperes within village or city limits upon any railroad.

For testing other meters a fee equal to the estimated cost to the commission will be required.

NEW JERSEY.

No. 26. Upon formal application by any customer to the Board of Public Utility Commissioners a test shall be made of the customer's meter by an inspector employed by the board. Such test shall be made as soon as practicable after receipt of the application. For such a test a fee of \$1 shall be paid by the customer at the time appli-

cation is made for the test; this fee to be retained if the meter is found to be slow or correct within the allowable limits. If the meter is found to be fast beyond the allowable limits the amount of \$1 will be refunded to the customer and collected from the utility owning the meter.

The utility owning the meter will be notified that such test is to be made, and should have a representative present to open the meter and seal it after the test.

NORTH DAKOTA.

RULE 17. Tests upon application to commission.—(a) Upon formal application of any consumer to the commission, a test will be made upon the consumer's meter by an inspector employed by the commission, such test to be made as soon as practicable after the receipt of the application. For such test a fee of \$5 shall be paid by the consumer making application for the test; if the meter is found to be slow or correct within the allowable limit, then the amount deposited shall be retained by the commission, but if the meter is found to be fast beyond the allowable limit, then the \$5 paid by the consumer shall be returned to said consumer and the same amount shall be collected from the utility.

(b) Upon formal application of any consumer to the commission an electric demand test will be made upon the consumer's electric load, by an inspector employed by the commission, such test to be made as soon as practicable after receipt of the application and under exactly similar conditions of installation and operation as may be mutually agreed upon in writing, by the consumer and the utility. For such tests a fee of \$10 shall be paid by the consumer making the application for the test. If the electric demand is found to be higher than the demand fixed by the utility, or correct, said fee is to be retained by the commission, but if the electric demand shall be found to be less than the demand fixed by the utility, then the \$10 paid by the consumer shall be returned to said consumer and the same amount shall be collected of the utility.

OKLAHOMA.

RULE 19. Referee meter test by commission.—(a) Upon written application by any consumer to the commission a test will be made on the consumer's meter by a representative of the commission, such test to be made as soon as practicable after receipt of the application. In the event the commission is not properly equipped to make this test, its equipment is in use elsewhere, or it is not advisable to transport the commission's equipment to the place of test, a representative of the utility shall make the test in the presence of the commission's electrical engineer who shall observe and check the methods employed and the correctness of the result obtained. For such a test a fee as scheduled below shall be paid by the consumer at the time application is made for the test. The utility owning the meter will be notified that such test is to be made, and shall have a representative present to open the meter, assist in the test and adjust, and seal the meter after the test. If the meter is found to be correct or slow the above-mentioned fee will be retained by the commission. If the meter is found to be more than 3 per cent fast; that is, to have an average error in excess of 3 per cent, as determined by the method specified in rule 13, the amount of the fee will be refunded to the consumer and collected from the utility owning the meter.

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|--|---------|
| (1) For direct-current or single-phase watthour meters operating on circuits of 650 volts or less, and having not to exceed 25 amperes rated capacity | \$2. 00 |
| (2) For each additional 50 amperes or fraction thereof | . 50 |
| (3) For single-phase meters operating on circuits of more than 650 volts, and for polyphase meters, with or without instrument transformers, having to exceed 25 kilovolt-amperes rated capacity | 3. 00 |
| (4) For each additional 25 kilovolt-amperes or rated capacity | . 50 |

Where instrument transformers are used the rated capacity of the meter is considered to be that of the complete metering installation and is determined by taking into consideration the ratio of the instrument transformers.

(b) Any demand meter will be tested by a representative of the commission upon written application by the consumer and receipt of a fee of \$2. This fee shall be refunded to the applicant by the utility if the indicator be found to over register more than 3 per cent.

(c) The meter shall in no way be disturbed after the utility or its representative has received notice that application has been made for a referee test, unless authority to do so is first given in writing by the commission or by the consumer.

OREGON.

RULE 5. (b) Any customer may at any time make application to the commission for a test of his meter and shall deposit with the commission a fee for such test, fixed as hereinafter in these rules provided. Such fee shall be returned to the customer by the commission, and the amount thereof paid by the utility to the commission, if the meter is found to be fast in excess of the following limits, viz:

Gas meters (when passing gas at the rate of 6 cubic feet per hour per rated light capacity), 3 per cent.

Electricity meter, 4 per cent.

Water and other meters, 2 per cent.

RULE 23. *Fees for meter tests.*—(a) The amount of fee to be collected for meter tests made in accordance with the provisions of paragraph (b) of rule 5 shall be as follows:

For each single-phase or continuous-current electricity meter having a voltage rating of not exceeding 250 volts and a current capacity of not exceeding 25 amperes without having instrument transformers.	\$2. 00
For other electricity meters having a capacity not exceeding 100 amperes.	4. 00
For all other electricity meters.	8. 00

WASHINGTON.

RULE 5. If any consumer of gas, electric current, or water desires any meter test other than that provided for in the preceding rule [see Washington, under "Request tests"] said consumer shall first make application to the company who shall have 10 days within which to make said test and report the result thereof to the consumer, or to refuse altogether to make said test. Should the company refuse to make said test, or should the consumer not be satisfied with the accuracy of any test made by the company, the consumer may then make formal application to the commission, who shall cause such test to be made by an inspector appointed by the commission as soon as practicable after the receipt of the application. For such test made by the commission a fee of \$3 shall be paid by the consumer making the application if the meter is found to be slow or correct within the allowable limit, and by the company owning the meter if the meter is found to be fast beyond the allowable limit.

WEST VIRGINIA.

RULE 16. *Complaint tests.*—Upon formal written application to the Public Service Commission by any consumer a test shall be made upon the consumer's meter by an inspector of the commission. A report giving the results of the test shall be made to the consumer and the company, and a complete record of the test shall be kept in the office of the chief inspector of the commission. If the said meter shall be found to register not more than 2 per cent fast the cost of such inspection shall be borne by the consumer, but if the meter shall be found to register incorrectly to the consumer's prejudice, more than 2 per cent, the cost of such inspection shall be borne by the utility.

All inspections shall be made as soon as practicable. The charges fixed by the commission for making such tests are as follows:

- A. For direct-current watthour meters and single-phase alternating-current watthour meters operating on constant-potential circuits of not over 250 volts:

<i>Amperes rated capacity—</i>	<i>Fee.</i>
30 and under	\$1. 50
Over 30 to 100	3. 00
And for each additional 50 amperes or fraction thereof.	. 75

- B. For polyphase alternating-current watthour meters and for single-phase or direct-current watthour meters operating on circuits of over 250 volts, with or without instrument transformers:

<i>Kilowatts rated capacity—</i>	
5 kw. and under	2. 00
Over 5 to 25	3. 00
Over 25 to 100	6. 00
Over 100 to 500	15. 00
Over 500	30. 00

If a test is required on any meter not included in either of the above classifications, the commission will establish the fee therefor on application.

NOTE.—For the determination of the average percentage of accuracy the following rule is recommended as an equitable method:

All meters, whenever possible, shall be tested at two loads, one-tenth of the full rated capacity of the meter, and full-rated capacity of the meter.

The average of these tests shall be deemed the condition of the meter.

WISCONSIN.

NO. 21. Any electricity meter may be tested by an inspector employed by the commission, upon written application of the consumer. For such a test a fee shall be forwarded to the commission by the consumer when making application; the amount of this fee shall be refunded to the consumer by the utility if the meter is found to be fast beyond the 4 per cent limit. The amount of fee to be collected for these tests so made shall be \$2 for each single-phase or continuous-current electricity meter having a voltage rating not exceeding 250 volts, and a current capacity not exceeding 25 amperes without having instrument transformers; for other electricity meters having a capacity not exceeding 100 amperes the test fee shall be \$4 per meter; for all others the fee shall be \$8 per meter.

REFUNDS AND BILL ADJUSTMENTS.

COLORADO.

RULE 40. *Adjustment of bills for meter errors.*—(a) If on test of any service watthour meter, made upon the request of the consumer, by either the utility or the commission, it is found to be more than 3 per cent fast at any load, additional tests shall be made to determine the average error of the meter.

(b) *Average error.*—The average error of a meter in tests made by the commission or the utility at the request of the consumer shall be defined as one-half the algebraic sum of (1) the error at light load, and (2) the error at heavy load.

(c) When a meter is found to have a positive average error; that is, is fast in excess of 3 per cent in tests made at the request of the consumer by either the commission or the utility, the utility shall refund to the consumer an amount equal to the excess charged for the kilowatthours incorrectly metered for a period equal to one half of the time elapsed since the last previous test, but not to exceed six months.

(d) When a meter is found to have a negative average error; that is, is slow in excess of 3 per cent in tests made at the request of the consumer by either the commission or the utility, the utility may make a charge to the consumer for the kilowatt-hours incorrectly metered for a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months.

(e) If a meter is found not to register for any period, the utility shall estimate a charge for the kilowatt-hours used by averaging the amounts registered over similar periods preceding or subsequent thereto, or over corresponding periods in previous years.

CONNECTICUT.

RULE 6. *Adjustment of bills for meter errors.*—(a) Whenever the test of a meter under rule 5 reveals it to be fast beyond the limits prescribed, the utility shall refund to the customer such percentage of the amount of the bills covering metered consumption for the previous six months, as the meter was found to be in error at the time of the test, unless it can be shown from the records of the utility or complainant that the error found has been extant for a greater or lesser period, in which case the refund shall cover such actual period.

ILLINOIS.

RULE 17. *Adjustments of bills for meter error.*—(a) Whenever any test by a utility or by the commission of a watthour meter while in service or on its removal from service shall show such meter to have an average error of more than 4 per cent, the following provisions for the adjustment of bills shall be observed:

The error found, except in the case of installation tests, shall be considered for purpose of this rule to have existed for the six months preceding the test or for the time the meter has been in service at that location if less than six months, unless the inaccuracy can be shown to have existed for a different period. The error found on installation tests shall be considered to have existed from the date of installation of the meter, as provided in rule 13 (b). If the meter be found faster than allowable the utility shall refund to the consumer concerned any overcharge caused thereby during the period of inaccuracy of the meter as above defined. The actual error of the meter, and not the difference between the allowable error and the error as found, shall be used as the basis for calculating the refund.

If the meter be found on any test other than an installation test to under-register, the utility may render a bill to the consumer concerned for the estimated consumption not covered by bills previously rendered during the period of inaccuracy as defined above in paragraph 17 (a). Such action shall be taken, however, only in cases where the bill for estimated inaccuracy amounts to \$0.50 or more, and all such bills shall be conditional upon the utility not being at fault for allowing the inaccurate meter to remain in service. The utility shall, in no case, render a bill for under-registration where a meter has been found slow unless the particular meter has been tested in conformity with rules 12, 13, and 14, and shall not render a bill for under-registration where a meter has been found slow on installation test, unless such test shall have been made within 60 days after installation of the meter. In the case of a nonregistering meter which has been read during the period of nonregistration the utility shall not render a bill for an estimated consumption extending over more than twice the regular interval between readings.

(b) Whenever a utility or the commission shall find a watthour meter in its place of service to be creeping, an estimate shall be made of the registration which the creeping has produced during the period of inaccuracy as specified under (a) and a corresponding refund shall be made to the consumer.

(c) Whenever any test by a utility or by the commission of a demand meter while in service or on its removal from service shows such meter to be more than 4 per cent in error, the provisions of No. 17 (a) covering the adjustment of charges in the case of service watthour meters shall be observed in so far as they are applicable. If the

demand meter depends for its readings upon actuations from the watthour meter, the average error of the demand meter shall be determined from the heavy load accuracy of the watthour meter in conjunction with the accuracy of the demand meter itself.

INDIANA.

RULE 19. *Adjustment of bills for meter error.*—If on test of any service meter, either by the utility or by the commission, such meter shall be found to have a percentage of error greater than that allowed for watthour meters, the following provisions for the adjustment of bills shall be observed:

(a) *Fast meters.*—When a meter is found to have a positive average error; that is, is fast in excess of 4 per cent, in tests made at the request of the consumer, the utility shall refund to the consumer an amount equal to the excess charged for the kilowatt-hours incorrectly metered, for a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months. No part of a minimum service or demand charge need be refunded.

(b) *Slow meters.*—When a meter is found to have a negative average error; that is, is slow in excess of 4 per cent, in tests made at the request of the consumer, the utility may make a charge to the consumer for the kilowatthours incorrectly metered for a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months. If a meter is found not to register for any period, the utility shall estimate and charge for the kilowatthours used by averaging the amounts registered over similar periods, preceding or subsequent thereto, or over corresponding periods in previous years. Such action shall be taken only in cases of substantial importance where the utility is not at fault for allowing the incorrect meter to be in service.

NEW HAMPSHIRE.

RULE 8.⁴⁰ Whenever a meter is tested under rules 5, 6, or 7 and is found to be more than 4 per cent fast, the utility shall refund to the consumer such percentage of the amount of bills for the previous six months, or for the time the meter was in service or since the last preceding test not exceeding six months, as the meter was found to be in error at the time of test: *Provided, however,* That the commission in any case may relieve the utility from this requirement to such extent as the facts may appear justly to require. Whenever a meter so tested is found to be more than 4 per cent slow, the utility may make application to the commission for authority to render a bill to the consumer for electricity supplied during the preceding six months, not covered by bills previously rendered; but such application should be made only in cases of substantial importance, and should be accompanied by a statement showing the utility not to be in fault for allowing the incorrect meter to be in service.

MICHIGAN.

38. *Adjustment of bills for meter errors.*—If the result of a test of any service watthour meter, made at the request of the consumer, either by the utility or by the commission, shall show such meter to have a percentage of error greater than allowed for watthour meters by these rules then adjustments shall be made according to the following regulations:

(a) *Fast meters.*—When a meter is found to be fast, with a positive average error greater than 4 per cent then the consumer shall be entitled to a rebate from the utility, such rebate to be equal in amount to the excess charged for energy not actually consumed, based upon the assumption that the error as determined existed for a period equal to one-half of the time elapsed since the last previous test: *Provided, however,* That if the consumer shall be able to establish the fact that such error existed for a period longer than one-half of the time elapsed since the last previous test, or if the

⁴⁰ This rule shall not be taken to require the refund of any part of a minimum service or demand charge.

utility shall be able to establish the fact that such error did not exist for a period equal to one-half of such time, then the consumer shall be entitled to a rebate for such period of time as shall be shown such error actually existed.

(b) *Slow meters.*—When a meter is found to be slow, with a negative average error equal to or greater than 50 per cent or has not registered for any period, then the utility shall be entitled to make a charge to the consumer for an amount of energy estimated to have been consumed, such estimate being based upon the average of the amounts registered over similar periods preceding or subsequent thereto, or over corresponding periods in other years: *Provided, however,* That such action may be taken only in cases of considerable importance where the utility is not at fault for allowing the incorrect meter to be in service.

(c) *Incorrect demand charge.*—No part of a minimum service or demand charge when incorrectly measured need be refunded.

MONTANA.

RULE 26. *Adjustment of bills for error.*—If on test of any service meter, either by the utility or the commission, such meter shall be found to have a percentage of error greater than that provided for in these rules, the following provisions for the adjustment of bills shall be observed:

(a) When a meter is found to have a positive error; that is, is fast in excess 4 per cent, the utility shall refund the consumer an amount equal to the excess charged for the kilowatthours incorrectly metered, for a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months. No part of a minimum service or demand charge need be refunded.

(b) When a meter is found to have a negative average error; that is, is slow in excess of 4 per cent, the utility may make a charge to the consumer for the kilowatthours incorrectly metered for a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months. If a meter is found not to register for any period, the utility shall estimate the charge by averaging the amounts registered over similar periods, preceding or subsequent thereto, or over corresponding periods in previous years. Such action shall be taken only in cases of substantial importance where the utility is not at fault for allowing the incorrect meter to remain in service.

NORTH DAKOTA.

RULE 19. *Adjustment of bills for meter error.*—If on test of any service meter, either by the utility or by the commission, such meter shall be found to have a percentage of error greater than that allowed for watt-hour meters the following provisions for adjustment of bills shall be observed:

(a) *Fast meters.*—When a meter is found to have a positive average error; that is, is fast in excess of 4 per cent, in tests made at the request of the consumer, the utility shall refund to the consumer an amount equal to the excess charged for the kilowatt-hours incorrectly metered, for a period equal to one-half of the time elapsed since the last previous test, but not to exceed three months. No part of a minimum service or demand charge need be refunded.

(b) *Slow meters.*—When a meter is found to have a negative average error; that is, is slow in excess of 4 per cent, in tests made at the request of the consumer, the utility may make a charge to the consumer for the kilowatthours incorrectly metered for a period equal to one-half of the time elapsed, since the last previous test, but not to exceed three months. If a meter is found not to register for any period the utility shall estimate and charge for the kilowatthours used by averaging the amounts registered over similar periods preceding or subsequent thereto, or over corresponding periods in previous years. Such action shall be taken only in cases of substantial importance where the utility is not at fault for allowing the incorrect meter to be in service.

OKLAHOMA.

RULE 36. *Refunds and prorated bills.*—(a) Whenever a meter in service is found upon test, made by the utility or the commission at the request of the consumer, to have a positive average error; that is, is fast in excess of 3 per cent, the utility shall refund to the consumer an amount equal to the excess charged for the kilowatthours incorrectly metered, for a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months, unless it can be shown that the error was due to some cause, the date of which can be fixed, in which case the refund shall be computed back to, but not beyond such time.

(b) When a meter is found to have a negative average error; that is, is slow in excess of 3 per cent, in tests made at the request of the consumer, the utility may make a charge to the consumer for the kilowatthours incorrectly metered, for a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months, unless it can be shown that the error was due to some cause, the date of which can be fixed, in which case the charge shall be computed back to, but not beyond such time. Such action shall be taken, however, only in cases where the bill for estimated inaccuracy amounts to \$0.50 or more. The utility shall, in no case, render a bill for under-registration where a meter has been found slow, unless the particular meter has been tested and calibrated in conformity with rules 13, 14, 15, 16, and 17 of this order.

(c) If a meter is found not to register for any period, the utility shall estimate and charge for the kilowatthours used by averaging the amounts registered over similar periods, preceding or subsequent thereto, or over corresponding periods in previous years.

(d) Whenever a utility or the commission shall find a watthour meter in its place of service to be creeping, an estimate shall be made of the registration which the creeping has produced during the period of inaccuracy, and a corresponding refund shall be made to the consumer.

(e) Whenever any test by a utility or by the commission of a demand meter while in service or on its removal from service shows such meter to be more than 3 per cent in error, the provisions of rule 35 (a) and (b), covering the adjustment of charges in the case of service watthour meters shall be observed in so far as they are applicable. If the demand meter depends for its readings upon actuations from the watthour meter, the average error of the demand meter shall be determined from the heavy-load accuracy of the watthour meter in conjunction with the accuracy of the demand meter itself.

(f) The actual error of the meter, and not the difference between the allowable error and the error as found, shall be used as the basis for calculating the refund or charge mentioned in this rule. No part of the minimum service or demand charge, which has been correctly made, need be refunded.

OREGON.

RULE 6. *Adjustments of bills for meter errors.*—(a) If on test of any meter, for any cause, either on removal from or while in service, it shall be found fast beyond the limits specified in rule 5 (b), the utility shall refund to the consumer such percentage of the amount of the bills to the customer for the period of three months just previous to such test of the meter as the meter shall have been shown to be in error at the time of said test. If the meter is found not to register or to register less than 50 per cent of the actual consumption, an average bill may be rendered to the customer by the utility, subject to the approval of the commission.

PENNSYLVANIA.

No. 24. *Refund for overcharge.*—If a meter be found to be fast by more than 4 per cent as defined in rule 12 at any test, an allowance or refund shall be made to the

consumer by the utility, equal to all the excess charged the consumer, figured back from the date of test through the entire period of the current bill, unless it can be shown that the error is due to an accident or other cause, the exact time of which is known, in which case it shall be figured back to such time.

SOUTH CAROLINA.

RULE 18. *Adjustment of bills for meter error.*—(a) *Fast meters.*—If on a test of any electric meter made by the commission, as may be later authorized, or the utility under rules 16 and 17, whether at the request of a consumer or not, it may be found more than 4 per cent fast, the utility shall refund to the consumer such percentage of the amount of his bills for the period of 60 days, just previous to the removal of such meter from service, or, for the time the meter was in service, not exceeding 60 days, as the meter shall have been shown to be in error by such test in excess of 4 per cent: *Provided, however,* That if the error was due to some cause, the date of which can be fixed, and which date is within the 60 days' period, herein mentioned, the overcharge shall be computed back to, but not beyond, such time. No part of any minimum service charge shall be refunded.

(b) *Slow meters.*—If on test of any electric meter made by the commission, as may be later authorized, or by the utility under rules 16 and 17, whether at the request of a consumer or not, it be found more than 4 per cent slow, the utility may collect from the consumer the amount estimated to be due from the consumer for electricity used but not charged for in bills rendered, not to exceed the 60 days previous to removal of the meter.

WEST VIRGINIA.

RULE 31. *Refunds.*—Whenever a meter, in service is found upon periodic, request, or complaint test to be more than 2 per cent fast, additional tests shall at once be made as stipulated in "note" of rule 16, so as to determine the average error of the meter.

Whenever a meter is found to have an average error in registration exceeding 2 per cent as above defined, the utility shall refund to the consumer such a percentage of the amount of the bills for a period equal to one-half of the time elapsed since the last previous test as the meter is found to be in error at the time of the test, but in no case to exceed three months; provided, however, that the commission may relieve the utility from this requirement in any particular case to any extent that the facts may appear justly to require.

Similarly, when a meter is found to be more than 2 per cent slow by like tests, the utility may make application to the commission for authority to render a bill to the consumer for electricity supplied, during a period equal to one-half of the time elapsed since the last previous test, not covered by bills previously rendered; but said application should be made only in cases of substantial importance, and should be accompanied by a statement of all the facts in the case.

REPLACEMENT OF METERS.

MONTANA.

RULE 18. *Replacement of meter.*—(a) Whenever a consumer requests the replacement of the service meter on his premises, such request shall be treated as a request for a test of such meter, and as such shall fall under the provisions of rule 25.

(b) Whenever a consumer moves from the location where he is receiving service and thereby requires the disconnecting and connecting at a new location, and the same work has been done for him within one year preceding, the utility may make a charge for the work based on actual cost.

(c) For any temporary service the consumer must pay the cost of connecting and disconnecting the service.

(d) Consumers must notify the utility of any additions or alterations made to their wiring.

NEW JERSEY.

No. 28. No utility shall make any charge for replacing a meter where such replacement is required by a customer, unless the meter first referred to has been in use less than one year, in which case a charge, which in no case shall exceed \$1, may be made to cover the actual expense of making the change.

SOUTH CAROLINA.

RULE 24. *Replacement of meters and changes in location of service.*—(a) Whenever a consumer requests the replacement of the service meter on his premises, such request shall be treated as a request for the test of such meter, and as such, shall fall under the provisions of rule 17.

(b) Whenever a consumer moves from the location where current is used by him, and thereby requires the disconnecting and connecting at a new location of the electric supply, and the same work has been done for him within one year preceding, the utility may make a charge.

REPORTS AND RECORDS.

ARIZONA.

It is ordered that all electric, gas, water, and street railway corporations operating utilities in the State of Arizona shall keep all books, records, and accounts of all kinds at some convenient location within the State of Arizona, preferably at the place of doing business or their local office or headquarters.

COLORADO.

RULE 16. *Reports to commission.*—Each utility shall make special reports at such time and in such form as the commission may from time to time require.

CONNECTICUT.

RULE E-18. *Report on types of meters.*—(a) Each utility shall report in duplicate to the commission before January 31, 1916, the types and quantity of each type of meters in its service, and yearly thereafter. Whenever a utility places any new type of meter in service, this type must be promptly reported and described to the commission.

DISTRICT OF COLUMBIA.

SECTION 9. Each corporation shall submit to the commission in the form prescribed by the commission a monthly report of the results of all tests of meters made during that month. Such reports shall be made for the calendar month and shall be submitted not later than the 15th of the month following.

ORDER NO. 140. (1) That the attached blank form ⁴¹ is hereby adopted by the commission as a form for the use of utilities in furnishing the information necessary.

(2) That each utility delivering electricity to commercial customers or using or delivering electricity for the operation of street railways in the District of Columbia shall hereafter furnish to the commission the information for each month called for on the said blank form not later than the 25th day of the month following.

⁴¹ The form referred to is a statement showing kilowatthours generated, used, and delivered during each month. The items to be listed are: Delivered to commercial customers; used by or delivered to each street railway company; kilowatthours used or delivered for any purpose not specifically stated herein; kilowatthours delivered for street and park lighting; total kilowatthours accounted for; total kilowatthours unaccounted for; total kilowatthours generated; average cost per kilowatthour generated.

(3) That this order shall take effect immediately and shall continue in force until otherwise ordered by the commission.

1. That the attached form⁴² is hereby adopted by the commission as a form for the use of utilities in furnishing the information necessary.

2. That each utility delivering electricity to commercial customers in the District of Columbia shall hereafter furnish to the commission for each fiscal month the information called for on the said blank form not later than the last day of the month following.

3. That each utility delivering electricity to commercial customers in the District of Columbia, shall, from and after January 1, 1916, keep such books, records, and accounts as are necessary in order to compile therefrom the data ordered to be furnished to the commission on the attached form.

4. That this order shall take effect immediately and shall continue in force until otherwise ordered by the commission.

ILLINOIS.

RULE 1. *Records and reports.*—All records required by these rules shall be preserved for at least three years after they are made. Such records shall be kept within the State, at an office or offices of the utility located in the territory served by it, and shall be open for examination by the commission or its authorized representatives. Where the utility elects to keep records at a central office, duplicates must be kept in the office of the utility nearest to the point where the record originates. Each utility shall notify the commission of the office or offices at which the various classes of records are kept and of the name, address, and title of the officer to whom correspondence relating to these rules is to be addressed, and shall file with the commission such reports as the commission may from time to time require.

INDIANA.

RULE 6. *Records to be kept in the State.*—All records required by these rules shall be preserved for at least three years after they are made. Such records shall be kept within the State, at an office or offices of the utility located in the territory served by it, and shall be open for examination by the commission or its representative. Each utility shall notify the commission of the office or offices at which the various classes of records are kept.

RULE 9. *Reports to the commission.*—Each utility shall file such reports with the commission as the commission may from time to time require.

MARYLAND.

5. All records shall be preserved in the office of the utility in the State of Maryland and shall at all times be open to inspection by an authorized representative of the commission. These records must be preserved for a period of at least 12 months: *Provided, however,* That any utility may report a summary by months of such records to the commission for each calendar year. After such report has been made and the utility has been advised by the commission of its receipt, and in the event that no inquiry or investigation is then in progress by the commission requiring the details of such records, such records as have been so reported by summary and the receipt acknowledged may be disposed of by the utility as may seem best to it.

Each utility shall report to the commission as and when called upon the results of all tests required to be made, or the information contained in any records required to be kept by the utility.

⁴² The form referred to is a standard showing the following items under the various rate schedules of the company: (a) Number of customers; (b) total of watthours; (c) total revenue; (d) customers paying minimum bill.

MICHIGAN.

5. *Availability.*—All records required by these rules shall be kept within the boundaries of the State, at the offices of the utility located in the territory served, and shall be available at all reasonable times for examination by an authorized representative of the commission. Each utility shall, upon request, inform the commission of the offices at which the records are kept. All such records shall be carefully preserved for at least three years after they are made.

MONTANA.

RULE 30. Reports.—Each utility shall, at such times and in such manner as the commission may prescribe, report to the commission the results of any test or tests required to be made or the information contained in any records required to be kept by the utility.

NEW HAMPSHIRE.

RULE 18. Each utility at such times and in such form as the commission shall require shall report to the commission the result of voltage surveys, interruptions of service, and the number of meters purchased, installed, removed from service, and tested.

NEW JERSEY.

RULE 24. Complete records shall be kept in the local office of all periodic tests and tests on old meters brought in. These records shall be available for examination at any time by the inspectors of the board.

A report shall be made to the board at stated intervals giving a summary of the tests. Each utility having more than 500 meters shall report monthly. Utilities having less than 500 meters shall report quarterly. Blank forms will be furnished by the board on which reports are to be made.

NEW YORK.

Electrical corporations furnishing electrical energy within the State of New York shall test, in the manner hereinafter prescribed, all watthour meters which are in service for the purpose of billing. Reports of the tests shall be made on the forms hereinafter prescribed.

SECTION 1. A complaint meter test is a test of a watthour meter made by an electrical corporation upon the premises where the meter is installed, as a result of a complaint of the consumer.

SECTION 2. A periodic meter test is a test of a watthour meter made by an electrical corporation in the regular course of its business upon the premises where the meter is installed, but not at the time of installation, which test is not made as the result of a complaint from the consumer nor by the direction of the corporation, of an officer or of an employee thereof that a special test be made.

SECTION 3. An office meter test is a test of a watthour meter made by an electrical corporation upon the premises where the meter is installed by direction of the corporation, of an officer or of an employee thereof that a special test be made.

SECTION 4. A service meter test is any test of a watthour meter made on a consumer's premises within a specified period after the introduction of a new type on the company's system. For a direct-current type meter the period shall be two years. For an alternating-current type meter the period shall be three years.

SECTION 30. A recommended form of calibration card for indicating instruments is given below.

SECTION 31. Reports of tests of watthour meters shall be made for the calendar month, shall be filed not later than the fifteenth of the following month and shall be printed on sheets 8½ by 11 inches in size.

If for any reason no tests are made in the month the form shall be filed bearing the statement "No tests made."

SECTION 32. All reports of complaint, periodic, and office tests shall be made in the form designated "Complaint, Periodic, and Office Tests," as given below.

SECTION 33. All reports of service tests shall be made in the form designated "Service Tests," as given below.

NORTH DAKOTA.

RULE 6. *Records to be kept in the State.*—All records required by these rules shall be preserved for at least three years after they are made. Such records shall be kept within the State, at an office or offices of the utility located in the territory served by it, and shall be open for examination by the commission or its representative. Each utility shall notify the commission of the office or offices at which the various classes of records are kept.

RULE 9. *Reports to the commission.*—Each utility shall file such reports with the commission as the commission may from time to time require.

OKLAHOMA.

RULE 29. *Records shall be kept within the State.*—Unless otherwise specified herein, all records required by these rules shall be preserved by the utility for at least two years after they are made. Such records shall be kept within the State at the office or offices of the utility, and shall be open for examination by the commission, or its representatives. Each utility shall notify the commission as to the location of the office or offices at which the various classes of records are kept, and shall file with the commission such reports as the commission may from time to time require.

PENNSYLVANIA.

No. 7. *Maintenance and inspection.*—Each utility shall maintain its equipment and facilities, and shall make periodic inspection of same, all in accordance with good practice, and in a manner satisfactory to the commission. Each utility shall also keep a complete record of all such inspections, as specified in rule 10, and shall file with the commission a statement of the condition of the equipment and facilities, and such copies of the reports of inspections, when and in such form as the commission may require.

No. 10. *Records and reports.*—All records required by these rules shall be kept within the State at an office or offices of the utility located in the territory served by it, and shall be open for examination by the commission of the office or offices at which the various classes of records are kept, and shall file with the commission such reports as the commission may from time to time require.

SOUTH CAROLINA.

RULE 4. *Records.*—(a) A complete record shall be kept of all tests and inspections made under these rules as to the quality or condition of service which is rendered.

(b) All records of tests shall contain complete information concerning the tests, including the date, hour, and place where the test was made; the name of the person making the test, and the result.

All records required by these rules shall be preserved by the utility for at least two years after they are made. Such records shall be kept within the State at the office or offices of the utility, and shall be open for examination by the commission or its representatives at all reasonable hours.

RULE 5. *Reports to commission.*—Each utility shall, at such times and in such form as the commission shall prescribe, report to the commission the results of all tests required to be made, or the information contained in any records required to be kept by the utility.

WEST VIRGINIA.

RULE 35. Reports to commission.—Every utility shall make special reports at such time and in such form as the commission may from time to time require.

REQUEST TESTS BY CUSTOMER.

ARIZONA.

RULE 18. Each utility supplying electrical energy shall make a test, upon request of a consumer, of a meter, provided such consumer does not make a request for a test more frequently than once in 12 months; and further provided that the meter in question has not been tested within the previous 12 months by the utility or by the State or city sealer of weights and measures. When an application is made by a consumer for a meter test within the period of less than 12 months, above referred to, the utility shall refer the consumer to the State or city sealer of weights and measures to whom application can be made by the consumer for a meter test. The fee for making a test of an electric meter by the State or city sealer of weights and measures shall be the sum of \$1, and shall be advanced by the party demanding the test; but in case the meter be already in use and found to be measuring too fast by as much as 3 per cent, the sealer shall return the fee to the consumer, and said fee shall be and become a lawful charge against the furnisher. A report of the result of the test made by the utility at the request of the consumer shall be made to the consumer, and a complete record of all such tests shall be kept on file at the office of the utility.

COLORADO.

RULE 38. Request tests.—Each utility furnishing metered electric service shall make a test of the accuracy of any electric service meter free of charge upon request of a consumer; provided that the meter has not been tested within the 12 months' period prior to such request, and provided that the consumer will accept the results of such test as a basis for the settlement of the difference claimed. A written report giving the result of such test shall be made to the consumer requesting same, the original record being kept on file at the office of the utility for a period of at least two years.

CONNECTICUT.

RULE 5. Tests of meters by request of customers.—(a) Each utility shall, upon the written request of a customer, and, if he so desires, in his presence or that of his authorized representative, make, without charge, a test of the accuracy of the meter in use at his premises; provided, first, that the meter has not been verified by the utility or by the commission within the period of one year previous to such request; and, second, that the customer will agree to abide by the results of such test as the basis for the adjustment of disputed charges. A written report of the results of the test shall be furnished to the customer by the utility.

DISTRICT OF COLUMBIA.

SECTION 6. Request tests.—Each corporation shall, without charge, make a test of the accuracy of a meter upon request of a consumer, provided that the meter in question has not been tested by either the corporation or the commission within six months previous to such request. A report giving the results of the test shall be furnished to the consumer.

ILLINOIS.

RULE 15. Request tests.—Each utility furnishing metered electric service shall, without charge, test the accuracy of any meter upon written request by a consumer; provided that the meter in question has not been tested by the utility or by the com-

mission within six months previous to such request. If the consumer so desires he or his representatives shall have the privilege of witnessing the test. A written report, giving the results of the test, shall be made to the consumer.

INDIANA.

RULE 16. *Meter tests upon request by consumer to utility.*—Each utility supplying electrical energy shall make a test of the accuracy of registration of a meter upon request of a consumer, provided such consumer does not make request for tests more frequently than once in 12 months. A report giving the results of such tests shall be made to the consumer, and a complete record of the same shall be kept on file in the office of the utility.

MARYLAND.

5. (a) Each utility shall, at any time when requested by a consumer in writing, test the accuracy of the meter in use by him; provided, (1) that the meter in question has not been tested either by the utility or by the commission within one year previous to such request; and (2) that the consumer will agree to accept the result of the test made by the utility as determining the basis for settling the difference claimed; provided, that a record of such test is submitted to the commission by the utility in such detail that the result may be checked. No charge shall be made to the consumer for any such test. A written report giving the result of every such test shall be made to the consumer.

MICHIGAN.

32. *Tests upon request by consumer.*—Each utility supplying electrical energy shall make a test of the accuracy of registration of a meter upon request of a consumer, provided such consumer does not make request for tests more frequently than once in six months. A report giving the results of such test shall be made to the consumer in writing, and a complete record of the same shall be kept on file in the office of the utility.

MISSOURI.

RULE 33. Each utility furnishing metered electric service shall make a test of the accuracy of any electric service meter free of charge upon request of a consumer, provided that the meter has not been tested within six months previous to such request. The consumer shall be notified of the time and place of such test so that he may be present to witness same should he so desire.

A written report, giving the result of such request test, shall be made to the consumer requesting same, the original record being kept on file at the office of the utility under the provisions of rule No. 2.

MONTANA.

RULE 25. *Application for tests.*—(a) Each utility supplying electrical energy shall make a test of the accuracy of registration of a meter upon request of a consumer, provided such consumer does not make a request for a test of the same meter oftener than once in 12 months. A report giving the result of such test shall be made to the consumer.

NEVADA.

RULE 20A. Each company supplying electrical energy shall make a test of the accuracy of a meter upon request of a consumer, provided such consumer does not make request for tests more frequently than once in six months. Such test shall be made in the presence of the consumer, with meter connected in its place of service, and such meter shall not be uncovered for adjustment until settlement of complaint is made. A report giving the results of such tests shall be made to the consumer, and a complete record of the same forwarded to the Public Service Commission.

NEW HAMPSHIRE.

RULE 5. Each utility furnishing metered electric service shall make a test of the accuracy of any electric service meter upon the request of the consumer, made at the office of the utility, provided the consumer does not request such test more frequently than once in six months. A report giving the results of each request test shall be made to the consumer.

NEW JERSEY.

No. 25. Each electric utility shall, without charge, make a test of the accuracy of a meter upon request of a customer, provided such customer does not make a request for test more frequently than once in six months. A report giving results of such tests shall be made to the customer, and a complete record of such tests shall be kept on file at the office of the utility.

NORTH DAKOTA.

RULE 16. *Meter tests upon request by consumer to utility.*—Each utility supplying electrical energy shall make a test of the accuracy of registration of a meter upon request of a consumer, provided such consumer does not make request for tests more frequently than once in twelve months. A report giving the results of such test shall be made to the consumer, and a complete record of the same shall be kept on file in the office of the utility.

OKLAHOMA.

RULE 18. *Meter test upon request of consumers.*—Each utility shall, upon the written request of a consumer, and if he so desires, in his presence or that of his authorized representative, make, without charge, a test of the accuracy of the meter in use at premises; provided, first, that the meter has not been verified by the utility or by the commission within a period of one year previous to such request, and second, that the consumer will agree to abide by the results of such test as a basis for the adjustment of disputed charges. A written report of the results of the test shall be furnished to the consumer by the utility, and a copy of this report, and a complete record of such test shall be kept on file at the office of the utility for a period of at least two years.

OREGON.

RULE 5. (a) Each utility shall, at any time when requested by a customer, test the accuracy of the meter in use by him free of charge, provided such meter has not been tested by the utility or by the commission within the period of one year immediately preceding the request.

PENNSYLVANIA.

No. 18. *Request tests.*—Each utility shall, upon the written request of a consumer, and if he so desires, in his presence or that of his authorized representative, make a test of the accuracy of his meter. When a consumer desires, either personally or by a representative, to witness the testing of a meter, he may require the seal of the meter to be broken only in his presence or that of his representative. If the meter so tested shall be found to be accurate within the limits specified in rule 11 a fee determined from the schedule indicated below shall be paid to the utility by the consumer requiring such test; but if not so found then the cost thereof shall be borne by the utility furnishing the service. When making such request the consumer shall agree to the basis of payment herein specified. A report of such test shall be made to the consumer, and a complete record of such test shall be kept on file as specified in rule 10.

Schedule of Fees for Testing Watthour Meters.

- (a) For direct-current and single-phase meters operating on 600 volts or less, up to and including 25 amperes rated capacity of the meter element..... \$1.50
- (b) For each additional 50 amperes or fraction thereof..... .50
- (c) For single-phase meters above 600 volts and for polyphase meters with or without instrument transformers, up to and including 25 kw. rated capacity of the circuit..... 2.50
- (d) For each additional 25 kw. rated capacity or fraction thereof..... 2.50

Rates for meters not included in the above classification, or so located that the cost is out of proportion to the fee specified, will be furnished by the commission upon receipt of complete specifications.

SOUTH CAROLINA.

RULE 17. *Meter testing on request of consumers.* (a)—Each utility shall, at any time (when requested in writing by a consumer) upon reasonable notice, test the accuracy of the meter in use by him.

No deposit or payment shall be required from the consumer for such meter test except when a consumer, whose average monthly bill for electric service is less than \$25, requests a meter test within six months after date of the installation or the last previous test of this meter, in which case he shall be required by the utility to deposit with it, to cover the reasonable cost of such test, an amount not to exceed the following:

- (1) For direct current and single-phase meters operating on 600 volts or less, up to and including 25 amperes rated capacity of the meter element..... \$1.50
- (2) For each additional 50 amperes or fraction thereof..... .50
- (3) For single-phase meters above 600 volts, and for polyphase meters, with or without instrument transformers, up to and including 25 kw. rated capacity of the circuit..... 2.50
- (4) For each additional 25 kw. rated capacity or fraction thereof..... 2.50

Rates for meters not included in above classification or so located that the cost is out of proportion to the fee specified, will be furnished by the commission upon receipt of complete specifications.

(b) The amount so deposited with the utility shall be refunded or credited to the consumer, as a part of the settlement of the disputed account if the meter is found, when tested, to register more than 4 per cent fast, otherwise the deposit shall be retained by the utility.

(c) A consumer may be present when the utility conducts the test on his meter, or, if he desires, may send an expert or other representative appointed by him.

(d) A report giving the name of the consumer requesting the test, the date of the request, the location of the premises where the meter has been installed, the type, make, size, and serial number of the meter, the date of removal, the date tested, and the result of the test, shall be supplied to such consumers within a reasonable time after the completion of the test.

WASHINGTON.

NO. 4. Each company supplying gas, electric current, or water shall make a test of the accuracy of a meter upon request of a consumer, and within 10 days thereafter, free of charge, provided such consumer does not make a request for a test more frequently than once in 12 months.

WISCONSIN.

RULE 20. Each utility furnishing metered electric service shall make a test of the accuracy of any electricity meter upon request of the consumer, provided the con-

sumer does not request such test more frequently than once in six months. A report giving the results of each request test shall be made to the customer and the complete original record kept on file in the office of the utility.

WEST VIRGINIA.

RULE 15. Request tests.—Every utility furnishing metered electric service shall make a test of the accuracy of any electricity meter upon request of the consumer, provided the consumer does not request such test more frequently than once in 12 months. If said meter shall be found to register not more than 2 per cent fast the consumer shall pay a fee of 50 cents to the utility. A report giving the result of each request test shall be made to the consumer and to the Public Service Commission and the complete original record shall be kept on file in the office of the utility for at least three years.

SERVICE REQUIREMENTS AND RATES.

MONTANA.

RULE 11. Service.—(a) To receive service a consumer will be required to submit a written application on one of the utility's regular forms.

(b) Charges for service will begin when the connection is made.

(c) Twenty-four hours' notice (Sunday and holidays not included) must be given in writing at the office of the utility to discontinue service.

(d) The consumer shall provide a suitable location for the meter as defined in these rules.

(e) Plans for special installations and installations of more than 10 kw. capacity, must be submitted to the utility for approval before work is commenced.

(f) A separate circuit and meter may be required by the utility for motors of larger capacity than one-third horsepower.

(g) The minimum charge will be waived for general lighting, cooking, and appliance service for periods of from one to three months during nonoccupancy, providing the building is unoccupied or no energy is used during the period. In order to obtain this waiver, the consumer must serve notice in writing at the utility's office at least three days prior to such nonoccupancy and immediately before reoccupancy so that the meter readings may be verified. The company may disconnect the service and remove the meter during such vacation period.

(h) Some utilities offer different kinds of service in different localities; to protect consumers against the purchase of improper appliances, they are advised to ascertain from the utility the kind of service supplied in the respective localities, as the utility will not be held responsible for or required to render service to any appliance not suited to the kind of service available. Any change in or addition to the character of service required by a consumer will be made only under contract providing terms approved by the commission.

RULE 12. Rates for general service.—(a) All lighting, heating, and metered service rates other than power, shall provide for:

(1) A minimum bill, designed to partially or entirely compensate the utility for the fixed charge, cost of meter reading, billing, and collecting.

(2) An "energy charge" to cover the operating costs of generating, transmitting, and distributing the electric current, including a fair return upon the utility's investment.

(b) When the charge for energy is less than the minimum, the consumer shall be billed at the minimum.

(c) Schedules for general service shall provide for a discount on bills paid within 10 days from date of bill.

(d) All bills are due when rendered; failure to receive bills will not entitle the consumer to the discount after the expiration of the 10-day limit.

(e) In case of failure to obtain a reading of the meter in any meter-reading period, an estimated bill may be rendered and so marked. A correction shall be made on the bill for the following month when the actual reading is available.

RULE 13. *Rates for power service.*—(a) Rates for industrial power shall consist of two parts:

(1) A "connected-load" charge to cover the fixed charges.

(2) An "energy charge" to cover the operating cost of generating, transmitting, and distributing the electric current.

(b) The consumer's bill for power in any one month shall be computed by adding the charge for energy to the connected-load charge. During months where no current is consumed, the net bill shall be the connected-load charge.

(c) In cases where the connected horsepower of individual motors is materially larger than the maximum demand, the charge may be based on a smaller number of horsepower corresponding with the actual maximum demand, providing that the maximum demand on which the fixed charge is based is not less than 50 per cent of the installed capacity.

(d) Where the installation consists of several motors and the load is of such a character that the maximum demand bears no definite relation to the connected load, a curve drawing or indicating wattmeter shall be installed and the connected-load charge based upon the actual maximum 15-minute demand registered each month.

(e) Lighting necessary in connection with industrial power may be connected to the extent of 3 per cent of the connected power load when the maximum 15-minute demand in any one month is in excess of 25 horsepower.

NOTE: Rule 13 shall not apply where power is sold wholesale under contract on maximum demand, or any basis other than the kilowatt-hour rate, provided such contracts conform with schedules that have been approved by the commission.

(f) Electric energy may be sold to large consumers, either industrial or municipal, on a flat basis, provided that the same charge is made to all consumers receiving the same amount of power under similar conditions; all flat-rate contracts must be submitted to and approved by the commission before being placed in effect.

(g) In temporary connections for power, the consumer will be charged for the entire cost of connecting and disconnecting service. The connected-load charge shall be \$3 per horsepower per month or fraction thereof, and the energy charge the same as prescribed in the utility's power schedule.

(h) Service to X-ray machines will be furnished under the power schedule, and the demand charge based on 50 per cent of the transformer rating recommended by the manufacturer of the X-ray machine.

RULE 14. *Heating and appliances.*—(a) In order to take advantage of special reduced rates for heating, cooking, and appliances the consumer's premises must be so wired that all current will pass through a separate meter to be installed by the utility. Consumers will be required to pay a minimum on each meter according to the utility's schedule.

(b) Each utility offering a schedule of rates for heating, cooking, and appliance service, will provide adequate capacity for any consumer within the area which it serves, desiring to take advantage of the schedule, providing the appliances installed conform with the service the utility is equipped to render. The utility will provide adequate transformer capacity to meet the demand, and stand the expense of the service to a point up to and including the meter. In cases where the service is demanded by a tenant, and the owner of the property will accept no responsibility for the permanency of the service, the utility may require the tenant to make a deposit equal to one-half the cost of the service, (not including transformer, but including the labor cost of hanging same). When such deposit has been made, the utility will thereafter credit the consumer an amount equal to 25 per cent of his net bill for the heating,

cooking or appliance service, until the full amount has been repaid, provided that there shall be no credit during months when the consumption is below the minimum.

(c) Utilities may offer a rate designed for joint residence lighting and heating under special rules and regulations designed to apply to the installation and conditions of service.

(d) The demand of an installation or system is the load which is drawn from the source of supply at the receiving terminals averaged over a suitable and specified interval of time. Demand may be expressed in kilowatts, kilovolt-amperes, amperes, or other standard units.

The maximum demand of an installation or system is the greatest of all the demands which have occurred during a given period. It shall be determined by measurement over a prescribed time interval. After being determined or specified in the contracts, it shall not be decreased except as specified in the company's rate schedule or contracts. If at any time the measured demand shall be found to be greater than determined or specified, the said greater demand shall be taken as the basis of charge thereafter. Special permission may be given by the company at its option to exceed the demand upon extraordinary occasions for a limited period.

SOUTH CAROLINA.

RULE 19. *Incidental lighting in connection with power service.*—With power installations exceeding 50 horsepower when the current for lighting is incidental thereto, and of the same class, the total consumption of current for both power and lighting shall be billed by the utility under the power schedules in force, said power schedule minimum, however, to be increased at the rate of \$1 per month for each kilowatt or fraction thereof of such installed lighting load: *Provided, however,* That if the power and lighting loads require different voltages, the consumer shall furnish the necessary transformers to make the applied voltage suitable for lighting.

SERVICE WIRES.

MICHIGAN.

15. All service wires passing through or along partitions and walls of buildings to entrance switches shall be installed in continuous lengths of approved rigid metal conduit up to the entrance switch, and be equipped with proper fittings. All entrance switches and cut-outs, except where installed on approved switchboards and panels, shall be inclosed in metal boxes of approved safety inclosed type so designed that the switch may be operated by a suitable handle located on the outside of the switch box. The covers of such switch boxes shall be so designed that they can be either sealed or locked in the closed position, and the switch handles shall be so designed that they can be locked in the open position and shall be marked so as to indicate, with the cover in the closed position, whether they are closed or open. No exposed wiring shall be installed between entrance switches and meters.

OKLAHOMA.

RULE 41. *Electric services.*—All property of the utility installed between the secondary distribution system, and the connection to consumer's house wiring, such as service wire insulators, insulator pins, brackets, meters, etc., shall in all cases be installed at the expense of the utility, and no part of the cost of such property or the cost of installing such property shall be included in the cost of any extension.

WEST VIRGINIA.

RULE 30. *Location on premises of outlet for service wires.*—Consumers are required to bring out their service wires at a point designated by the company, which must

extend at least 18 inches outside the building. In the event that the consumers desire to bring their service wires out at some other point, the consumer shall pay to the utility the actual additional cost incurred by the utility in connecting their service wires with each consumer's outlet. Consumers desiring underground, conduit, or special connections shall bear all additional expenses in connection therewith, and shall bring such connection to a point and in a manner designated by the company.

STATION RECORDS.

ARIZONA.

All electric utilities operating in the State of Arizona shall install such meters or other apparatus as may be necessary in determining the total amount of electrical energy generated and the total amount of electrical energy distributed; that such instruments be read and the energy generated and distributed be determined at frequent and regular intervals, and that permanent records be kept of the results of such readings.

In the case of street-lighting circuits and of sign-lighting installations in which a definite amount of current is used for a definite number of hours each day, a complete record of such current and such hours of use will be deemed a compliance with this order.

COLORADO.

RULE 42. *Station instruments and watthour meters.*—Each utility shall install such curve-drawing wattmeters, indicating instruments or watthour meters as may be necessary to obtain a daily record of the load, and a monthly record of the output of its plants. Each utility purchasing electrical energy shall install such instruments or watthour meters as may be necessary to furnish full information as to the monthly purchases.

CONNECTICUT.

RULE E-9. *Switchboard records.*—(a) Each utility shall keep a record of the time of starting and shutting down the generating units and feeders, together with the indication of the proper switchboard instruments at sufficiently frequent intervals to show the characteristics of the load.

ILLINOIS.

RULE 4. *Station records.*—(a) Each utility shall keep a record of (1) the time of starting and shutting down principal units at each power station and substation, (2) the time of switching feeders and street-lighting circuits, (3) the time of charging lightning arresters, and (4) the readings of the principal switchboard instruments at each generating station or substation at which an attendant is maintained, at intervals sufficiently frequent to show the characteristics of the load.

(b) Each generating station shall be provided with such instruments as are necessary to register the total amount of electric energy delivered from the station. In direct-current plants where storage batteries are used, an ammeter shall be provided to indicate the current delivered to the batteries.

Where a city having more than 75 consumers receives its main source of supply over a transmission line, instruments shall be provided at the substation to register the total amount of energy delivered through the substation. The metering equipment shall preferably be located on the low-voltage side of the installation. Where different utilities are operated the energy delivered to each shall be measured. If two or more cities or communities are considered as one unit for rate making purposes the total energy may be measured by a single installation.

INDIANA.

RULE 26. Station instruments and watthour meters.—Each utility shall install such curve-drawing wattmeters, indicating instruments, or watthour meters as may be necessary to obtain a daily record of the load and a monthly record of the output of its plants. Each utility purchasing electrical energy shall install such instruments or watthour meters as may be necessary to furnish full information as to the monthly purchase.

RULE 27. Station records.—Each utility shall keep a station record, which shall show: The time of starting and shutting down all generating units; the time of starting and disconnecting all street-lighting circuits; the readings of such instruments at each generating station and at such intervals as are necessary to determine the character of the load; all interruptions to service affecting the busbars or distribution system, with the time, duration, extent, and the cause, when known, of the interruption. An interruption is here defined, for the purpose of record only, as the interval of time during which the voltage falls below 50 per cent of the standard voltage.

MARYLAND.

F 1. Each utility shall keep a record of the time of starting and shutting down power station equipment or feeders, together with the readings of the principal switchboard instruments at such intervals as are necessary to indicate the characteristics of the load; together with the time of starting and disconnecting all street lighting circuits. The scope of this record shall show the time, duration, extent, and cause of the different operations of the power station and feeders.

2. Each utility shall provide such curve-drawing wattmeters, indicating wattmeters or watthour meters as may be necessary to obtain a daily record of the load and a monthly record of the output of its plants. Each utility purchasing electric energy shall install such indicating wattmeters and watthour meters as may be necessary to furnish full information as to the daily demand and monthly purchases.

MICHIGAN.

54. Station meters.—Each utility shall install and maintain in accurate working order such instruments as may be necessary for indicating the frequency, voltage, and current output at its plants and for making a daily record of voltage, kilowatt-load, and kilowatthour output, and kilowatthours purchased for its plants.

55. Station records.—Each utility shall keep a station record which shall show: The times of starting and shutting down all transmission and generating units; times of connecting and disconnecting street-lighting circuits; the interruptions of service, giving the time, duration, extent, and cause for such interruptions; the readings of such instruments as may be necessary for determining the character and intensity of the load and the character of service rendered, and any other desirable information.

MISSOURI.

RULE 7. Each utility shall keep a record of the time of starting up and shutting down all important items of equipment. A record shall be kept of the indications of the principal switchboard instruments, station meters, gages, etc., readings being taken at sufficiently frequent intervals to show the characteristics of the load. (Graphic recording instruments should be used for this purpose in accordance with the best modern practice when feasible.)

These records or charts, suitably identified and dated, shall be filed available for inspection by the commission and preserved for a period of at least two years.

Utilities which do not furnish 24-hour service shall report to the commission any proposed change in their regular operating schedule before the effective date of same.

MONTANA.

RULE 31. Station records.—(a) Each utility shall install such curve-drawing wattmeters, indicating instruments, or watthour meters as may be necessary to obtain a daily record of the load and a monthly record of the output of its plant. Each utility purchasing electrical energy shall install such instruments or watthour meters as may be necessary to furnish full information as to the monthly purchase.

(b) Each utility shall keep a station record or log book which shall show: The time of starting and shutting down each generating unit; the time of starting and disconnecting all street-lighting circuits; the reading of instruments at each generating station at such intervals as are necessary to determine the character of the load; all interruptions to service affecting the busbars or distribution system, with the time, duration, extent, and the cause of the interruption. An interruption is here defined for the purpose of the record only, as the interval of time during which the voltage falls below 50 per cent of the standard voltage.

The log book or record shall be signed by the person in charge before being relieved. He shall keep within sight an operating diagram or equivalent device indicating whether electrical supply circuits are open or closed, and where work is being performed. On circuits carrying normally in excess of 7,500 volts the operator in charge shall place "men at work" tags upon switches controlling any circuits upon which men are known to be working, and it shall be his duty to enforce the safety rules and permit only authorized persons to approach the equipment or lines. Section 27, chap. 171. Acts of fifteenth legislative assembly.

NEW HAMPSHIRE.

RULE 11. Each utility shall keep a record of the time of starting and shutting down power station equipment and feeders, together with the indication of the principal switchboard instruments at sufficiently frequent intervals to show the characteristics of the load; and shall maintain a record of all interruptions of service upon the entire system or major divisions of its system, and include in such record the time, duration, and cause of each interruption.

NEW YORK.

Second District.

ORDER OF MAY 13, 1912.—1. That each and every such electrical corporation be, and it hereby is, required and directed—

(1) To install and hereafter maintain watthour meters so connected that the reading of such meter or meters will record any kilowatthours of electric energy generated by such corporation;

(2) To install and thereafter maintain watthour meters so connected that the reading of such meter or meters will record in kilowatthours all electric energy bought by such corporation;

(3) To install and thereafter maintain either indicating or graphic wattmeters so that the load in kilowatts generated at any particular time will be indicated or recorded;

(4) To install and thereafter maintain either indicating or graphic wattmeters so that the load in kilowatts purchased at any particular time will be indicated or recorded;

(5) Permanently record so as to be accessible to this commission the following information: (a) The reading of the watthour meters at the same time daily for each day in the year; (b) at least half-hourly readings of wattmeters during the three consecutive hours of heaviest load each day, and at least hourly readings during the remainder of the day when the station is in operation; (c) the highest daily swing of the wattmeters noticed by the operators in charge, together with the time such swing occurred.

NORTH DAKOTA.

RULE 26. *Station instruments and watthour meters.*—Each utility shall install such curve-drawing wattmeters, indicating instruments, or watthour meters as may be necessary to obtain a daily record of the load and a monthly record of the output of its plants. Each utility purchasing electrical energy shall install such instruments or watthour meters as may be necessary to furnish full information as to the monthly purchase.

RULE 27. *Station records.*—Each utility shall keep a station record, which shall show: The time of starting and shutting down all generating units; the time of starting and disconnecting all street circuits; the readings of such instruments at each generating station and at such intervals as are necessary to determine the character of the load; all interruptions to service affecting the busbars or distribution system, with the time, duration, extent, and the cause, when known, of the interruption. An interruption is here defined, for the purpose of record only, as the interval of time during which the voltage falls below 50 per cent of the standard voltage.

OKLAHOMA.

RULE 30. *Station instruments and watthour meters.*—Each utility shall install such curve-drawing wattmeters, indicating instruments, or watthour meters as may be necessary to obtain a daily record of the load and a monthly record of the output of its plants. In direct-current plants where storage batteries are used, an ammeter shall be provided to indicate the current delivered to the batteries. Where a city having more than 75 consumers receives its main source of supply over a transmission line, instruments shall be provided at the substation to register the total amount of energy delivered through the substation. Where different utilities are operated the energy delivered to each shall be measured. If two or more cities or communities are considered as one unit for rate-making purposes, the total energy may be measured by a single installation.

RULE 31. *Station records.*—Each utility shall keep a record of: (1) The time of starting and shutting down principal units at each power station and substation; (2) the time of switching feeders and street-lighting circuits; (3) the time of charging lightning arresters; and (4) the readings of the principal switchboard instruments at each generating station or substation at which an attendant is maintained, at intervals sufficiently frequent to show the characteristics of the load.

PENNSYLVANIA.

No. 3. *Record of station voltage.*—Each utility shall keep in continuous operation at least one graphic recording voltmeter in each generating station. Each utility shall also place and connect additional graphic recording voltmeters at such places and for such periods of time as the commission may from time to time require. All records from such meters shall be kept on file as specified in rule 10.

SOUTH CAROLINA.

RULE 21. *Station instruments and records.*—Each utility shall have installed at its generating station suitable instruments to indicate the frequency and voltage of the service rendered from that station, together with the magnitude of the loads upon it. Each utility shall keep a station record which will show: (a) The time of starting and shutting down of generating units, the time of starting and disconnecting all street lighting circuits; (b) and readings of such instruments and at such intervals as are necessary to determine the character of the load; (c) all interruptions to service affecting bus bars or distribution system, with the time, duration and the cause, when known, of the interruption.

WISCONSIN.

RULE 24. Each utility furnishing electric service shall keep a record of the time of starting and shutting down power station equipment and feeders, together with the indication of the principal switchboard instruments at sufficiently frequent intervals to show the characteristics of the load, and shall maintain a record of all interruptions of service upon the entire system or major divisions of its systems, and include in such record time, duration, and cause of each interruption.

WEST VIRGINIA.

RULE 27. *Station wattmeters and watthour meters.*—Every utility shall install such watthour meters as may be necessary to obtain daily and monthly records of the output of its plants. Every utility purchasing electrical energy shall install such watthour meters as may be necessary to furnish full information as to daily and monthly purchases unless such instruments are installed by the selling company.

RULE 28. *Station records and interruptions of service.*—Every utility shall keep a record of: (1) The time of starting and shutting down power station equipment and feeders; (2) the indication of sufficient switchboard instruments to show the characteristics of the load; and (3) all interruptions of service upon the entire system or major divisions of its system, and include in such record the time, duration, and cause of each interruption.

STATUTORY PROVISIONS.

ILLINOIS.

I. STATUTORY.—The Illinois public utilities law, act of 1913, contains the following provisions:

10. *Definitions.*—The term "service" when used in this act is used in its broadest and most inclusive sense, and includes not only the use or accommodation afforded consumers or patrons, but also any product or commodity furnished by any public utility and the plant, equipment, apparatus, appliances, property, and facilities employed by or in connection with any public utility in performing any service or in furnishing any product or commodity and devoted to the purposes in which such public utility is engaged, and to the use and accommodation of the public.

54. *Standards of service.*—The commission shall have power to ascertain, determine, and fix for each kind of public utility suitable and convenient standard commercial units of service, product, or commodity, which units shall be lawful units for the purposes of this act; to ascertain, determine, and fix adequate and serviceable standards for the measurement of quantity, quality, pressure, initial voltage, or other condition pertaining to the performing of its service or to the furnishing of its product or commodity by any public utility, and to prescribe reasonable regulations for examining, measuring, and testing such service, product, or commodity, and to establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for examining, measuring, or testing such service, product, or commodity.

INDIANA.

RULE I. *Statutory provisions and definitions.*—Original jurisdiction lies with the municipal governments in Indiana in the matter of fixing standards of service, and also in the matter of extension of lines. The commission exercises only appellate jurisdiction in these matters, and in case of appeal to the commission will, to a very great extent, be governed by the following standards and requirements:

The Indiana public service commission act of 1913 contains the following provisions—

SECTION 110. Every municipal council shall have power, (a) to determine by contract, ordinance, or otherwise the quality and character of each kind of product or

service to be furnished or rendered by any public utility furnishing any product or service within said municipality and all other terms and conditions not inconsistent with this act upon which such public utility may be permitted to occupy the streets, highways, or other public property within such municipality, and such contract, ordinance, or other determination of such municipality shall be in force and prima facie reasonable. Upon complaint made by such public utility or by any qualified complainant as provided in section 57 the commission shall set a hearing as provided in sections 57 to 71, and if it shall find such contract, ordinance, or other determination to be unreasonable, such contract, ordinance, or other determination shall be void.

SEC. 36. The commission shall ascertain and fix adequate and serviceable standards for the measurement of quality, pressure, initial voltage, or other conditions pertaining to the supply of the product or service rendered by any public utility, and prescribe reasonable regulations for examinations and testing of such product or service and for the measurement thereof.

SEC. 37. The commission shall establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for measurements, and every public utility is required to carry into effect all orders issued by the commission relative thereto.

MONTANA.

RULE 1. *Authorization rules.*—(a) The public service law of the State of Montana provides that the Public Service Commission shall be empowered to fix rules and establish standards for service as follows:

Sec. (b) Chapter 52, session laws, 1913, provides: The commission shall ascertain and fix adequate and serviceable standards for the measurement of quality, pressure, initial voltage or other conditions pertaining to the supply of products or service rendered by any public utility and prescribe reasonable regulations for examinations and testing of such product or service and for the measurement thereof.

In accordance with the above provisions the Public Service Commission has adopted the following rules and fixed the standard for electric service, effective the 1st day of December, 1921. All provisions, rules, or standards conflicting with those contained herein are hereby superseded.

(b) The adoption of these rules shall in no way preclude the Public Service Commission from altering or amending them in whole or in part or from requiring any other additional service, equipment, facility, or standard, either upon complaint or upon its own motion, or upon the application of any utility. Furthermore, these rules shall not in any way relieve any utility from any of its duties under the laws of this State.

NORTH DAKOTA.

RULE 1. *Statutory provisions and definitions.*—The law covering the regulation of public utilities by the Board of Railroad Commissioners of the State of North Dakota, chapter 192, session laws of 1919, approved March 5, 1919, contains the following provisions:

SEC. 5. Whenever the commission shall find, after hearing, that the rules, regulations, practices, equipment, appliances, facilities, or service of any public utility, or the methods of manufacture, distribution, transmission, storage, or supply employed by it are unjust, unreasonable, unsafe, improper, inadequate, or insufficient, the commissioners shall determine the just, reasonable, safe, proper, adequate, or sufficient rules, regulations, practices, equipment, appliances, facilities, service, or methods to be observed, furnished, constructed, enforced, or employed, and shall, after hearing, fix the same by its order, rule, or regulation. The commission shall prescribe, after hearing, rules and regulations for the performance of any service or the furnishing of any commodity, of a character furnished or supplied by any public utility and, on demand and tender of rates, such public utility shall furnish such commodity, and render such service within the time and upon the conditions provided in such rules.

SEC. 9. (a) The commissioners and their officers and employees shall have the power to enter upon any premises occupied by any public utility for the purpose of making examinations and tests and exercising any of the powers provided for in this act and to set out and use on said premises any weights or appliances necessary therefor.

(b) Any consumer or user of any product or commodity or service of a public utility may have any appliance used in the measurement thereof tested by paying the fees fixed by the commissioners. The commissioners shall establish and fix reasonable fees to be paid for testing such appliances.

(c) The commissioners shall have the power to ascertain and fix just and reasonable standards, classifications, regulations, practices, measurements, or services to be furnished, imposed, observed, and followed by all public utilities; to ascertain and fix adequate and serviceable standards for the measurements, quantity, quality, pressure, initial voltage, or other condition pertaining to the supply of the product, commodity, or service furnished or rendered by any such public utility; to prescribe reasonable regulations for the examination and testing of such products, commodity, or service, and for the measurement thereof; to establish reasonable rules, regulation, specifications, and standards to secure the accuracy of all meters and appliances for measurements, and to provide for the examination and testing of any and all such appliances used for the measurement of any product, commodity, or service of any public utility.

OKLAHOMA.

RULE 1. *Authorization of rules.*—The corporation commission laws of Oklahoma provide that the Corporation Commission shall be empowered to establish rules and fix standards for electric service as follows:

The commission shall have general supervision over all public utilities, with power to fix and establish rates and to prescribe rules, requirements, and regulations affecting their services, operations, and the management and conduct of their business; shall inquire into the management of the business thereof, and the method in which same is conducted. It shall have full visitatorial and inquisitorial power to examine such public utilities, and keep informed as to their general conditions, their capitalization, rates, plants, equipments, apparatus, and other property owned, leased, controlled, or operated, the value of same, the management, conduct, operations, practices, and service; not only with respect to the adequacy, security, and accommodation afforded by their service, but also with respect to their compliance with the provisions of this act and with the constitution and laws of this State, and with the orders of the commission.

(b) In accordance with the above provisions, the corporation commission has adopted the following rules and fixed the following standards for electric service, to become effective the 1st day of July, 1922. All previous rules or standards conflicting with those contained herein are hereby superseded.

VOLTAGE SURVEYS.

ARIZONA.

RULE 17. Each electric utility shall at frequent and regular periods make measurements of the line voltage at the station; these records to be filed for reference.

Each electric utility shall also install such installations as may be necessary to measure its total station kilowatthour output and the records of output shall be preserved for reference.

COLORADO.

RULE 32. *Voltage surveys and records.*—Each utility shall provide itself with one or more portable indicating voltmeters, and each utility serving more than 200 consumers shall have one or more recording voltmeters of the curve-drawing type suitable

for the service voltages furnished. Each utility shall make a sufficient number of voltage surveys to indicate the character of service furnished from each center of distribution, and to satisfy this commission, upon request, of its compliance with the above voltage requirements. Utilities having curve-drawing voltmeters shall keep at least one of these instruments in continuous service at the plant, office, or some consumer's premises. All voltmeter records shall be available for inspection by the authorized representatives of this Commission for a period of at least two years from the date of such records.

CONNECTICUT.

RULE E-8. Voltage and current surveys and records.—(a) Each utility shall provide itself with one or more portable indicating voltmeters, and each utility serving more than 50 customers shall have one or more curve-drawing voltmeters and, if supplying constant current, one or more curve-drawing ammeters, these instruments to be of a type and capacity suited to the voltage and constant current supplied. Each utility shall make voltage surveys with sufficient frequency to indicate the service furnished from each feeder and to satisfy the commission of its compliance with the voltage requirements, and those having curve-drawing voltmeters shall keep at least one of these instruments in continuous service at the plant, office, or some customer's premises. All voltmeter and ammeter records shall be available for at least 15 months for inspection by the commission or anyone authorized by the commission.

INDIANA.

RULE 24. Voltage surveys and records.—Each utility shall provide itself with one or more portable indicating voltmeters, and each utility serving more than 250 consumers shall have one or more portable graphic recording voltmeters, these instruments to be of an acceptable type and having a range suited to the voltage supplied. Each utility shall make a sufficient number of voltage surveys to indicate the service furnished from each transformer and feeder and to satisfy the commission of its compliance with the voltage requirements, and those having graphic voltmeters shall keep at least one of these instruments in continuous service at the plant, office, or some consumer's premises.

ILLINOIS.

RULE 19. Voltage surveys.—(a) Each utility shall make voltage surveys at such intervals and of such comprehensiveness as may be necessary to keep itself fully informed regarding the character of the service being furnished from its system. Complete surveys shall be made at least every three years.

(b) All charts or readings taken in voltage surveys shall be preserved and filed in a systematic manner, accompanied by such information as may be required to show the date, hour, and place of the test, distance from the transformers (or from the plant if a direct-current system), size of transformers, the instrument used, and the name of the person making the test.

(c) For use in making voltage surveys, each utility shall provide one or more portable indicating voltmeters, and if serving more than 250 consumers, shall have one or more portable recording voltmeters. These instruments shall be of a type and range suited to the voltage supplied.

(d) Each utility having a portable recording voltmeter shall use it in making voltage surveys in all cities and villages served and shall keep it in continuous service at the plant, substation, office, or some consumer's premises. In each city where a utility has more than 500 consumers a recording voltmeter shall be kept in continuous service at some fixed point suitably located to indicate the voltage regulation at the plant or on the primary distribution circuits. This instrument shall not be used as a portable gauge in making voltage surveys.

MICHIGAN.

52. *Voltage surveys and records.*—Each utility shall provide itself with one or more portable indicating voltmeters, and if serving more than 200 consumers shall have one or more graphic voltmeters, of a type acceptable to the commission and range suitable to the voltage supplied. By the use of such meters each utility shall make voltage surveys of sufficient number and extent as to determine the actual service furnished from each transformer or feeder and ascertain whether or not such service is in compliance with the voltage requirements of these rules. Utilities having graphic voltmeters shall keep at least one of them in continuous service at the plant, or on the premises of some consumer.

MISSOURI.

RULE 28. To insure compliance with the requirements specified in rule 27, each utility furnishing electric service shall supply itself with one or more portable indicating voltmeters, suitable for the service voltages furnished, and maintain same in accurate condition. Where 250 or more consumers are served by any utility it must provide itself with one or more portable graphic recording voltmeters suitable for the service voltages furnished. A sufficient number of voltage surveys must be made by each utility to indicate that service furnished from various transformers and service mains is at all times in compliance with the foregoing requirements. When graphic recording voltmeters are used, each chart or record should cover an interval of at least 24 hours' duration. These records or charts, suitably identified and dated, shall be kept on file available for inspection for a period of at least two years.

MONTANA.

RULE 6. *Voltage records.*—Each utility shall provide itself with one or more portable indicating voltmeters, and each utility serving more than 250 consumers shall have one or more portable graphic recording voltmeters, these instruments to be of an approved type, having a range conforming to the voltage supplied. Each utility shall make a sufficient number of voltage surveys to indicate the service furnished from each transformer and feeder and to satisfy the commission of its compliance with the voltage requirements; utilities serving more than 250 consumers shall keep at least one graphic voltmeter in continuous service at the plant, office, or some consumer's premises.

NEW HAMPSHIRE.

RULE 15. Each utility which in any year shall have sold more than 50,000 kilowatt-hours, or have had more than 50 consumers shall provide itself with one or more portable recording or curve-drawing voltmeters, of a type and capacity suited to the voltage supplied, and shall make a sufficient number of voltage tests upon different parts of its system to indicate that the service furnished is in compliance with the voltage requirements. One of these recording voltmeters shall be kept in continuous service at the plant or office, or on some consumer's premises. All voltage records shall be kept open to public inspection at the office of the utility.

OKLAHOMA.

RULE 28. *Voltage surveys.*—(a) Each utility shall make voltage surveys at such intervals and of such comprehensiveness as may be necessary to keep itself fully informed regarding the character of the service being furnished from its system. Complete surveys shall be made at least every three years.

(b) All charts or readings taken in voltage surveys shall be preserved for at least three years and filed in a systematic manner, accompanied by such information as may be required to show the date, hour, and place of the test distance from the transformers (or from the plant if a direct current system), size of transformers, the instrument used, and the name of the person making the test.

(c) For use in making voltage surveys, each utility shall provide one or more portable indicating voltmeters, and if serving more than 250 consumers shall have one or more portable recording voltmeters. These instruments shall be of a type and range suited to the voltage supplied.

(d) Each utility having a portable recording voltmeter shall use it in making voltage surveys in all cities and villages served and shall keep it in continuous service at the plant, substation, office, or some consumer's premises. In each city where a utility has more than 500 consumers a recording voltmeter shall be kept in continuous service at some fixed point suitably located to indicate the voltage regulation at the plant or on the primary distribution circuits. This instrument shall not be used as a portable gauge in making voltage surveys.

NORTH DAKOTA.

RULE 24. Voltage surveys and records.—In the event that a utility company is not provided with an approved automatic voltage regulator it shall provide itself with one or more portable indicating voltmeters, and each utility serving more than 250 consumers shall have one or more portable graphic recording voltmeters, these instruments to be of an acceptable type and having a range suited to the voltage supplied. Each utility shall make a sufficient number of voltage surveys to indicate the service furnished from each transformer and feeder and to satisfy the commission of its compliance with the voltage requirements, and those having graphic voltmeters shall keep at least one of these instruments in continuous service at the plant, office, or some consumer's premises.

OREGON.

RULE 26. (a) Every electric utility shall provide itself with one or more portable indicating voltmeters, and each electric utility serving more than 250 customers shall have one or more portable graphic recording voltmeters. Such instruments shall be of a type and capacity suitable to the voltage supplied. Each electric utility shall make a sufficient number of voltage surveys to indicate the service furnished from each feeder, and when ordered by the commission, from any designated transformer, to satisfy the commission of its compliance with the voltage requirements. Utilities having graphic recording voltmeters shall keep at least one of these voltmeters in continuous service at the plant, office, or some customer's premises, and shall indicate on the graphic records the causes of extreme variations in voltage. All voltage records are to be kept open for public inspection.

SOUTH CAROLINA.

RULE 21. Voltage surveys and records.—Each utility shall provide itself with suitable indicating or recording voltmeters, and shall make a sufficient number of voltage tests periodically so as to insure compliance with the voltage requirements cited above. These tests shall be made at appropriate points upon the utility's distribution lines.

WISCONSIN.

RULE 26. Each utility furnishing electric service shall provide itself with one or more portable indicating voltmeters, and each utility serving more than 250 consumers shall have one or more portable graphic recording voltmeters, these instruments to be of a type and capacity suited to the voltage supplied. Each of the utilities shall make a sufficient number of voltage surveys to indicate the service furnished from each transformer and feeder, and to satisfy the commission of its compliance with the voltage requirements, and those having graphic recording voltmeters shall keep at least one of these voltmeters in continuous service at the plant, office, or some consumer's premises. All voltage records are to be kept open for public inspection.

WEST VIRGINIA.

RULE 26. *Voltage and current surveys and records.*—Every utility shall provide itself with one or more portable indicating voltmeters, and every utility serving more than 200 consumers shall have one or more recording (curve-drawing) voltmeters of type and capacity suited to the voltage supplied. Every utility should make a sufficient number of voltage surveys to indicate the service furnished from each center of distribution, and to satisfy the commission of its compliance with the voltage requirements, and those having curve-drawing voltmeters should keep at least one each of these instruments in continuous service at the plant, office, or some consumer's premises. All voltmeter and ammeter records shall be available for inspection by the commission, or anyone authorized by the commission.

VOLTAGE VARIATIONS.

COLORADO.

RULE 31. *Standard voltage and permissible voltage variation.*—(a) Each utility shall adopt a standard average voltage or standard average voltages, as may be required by its distribution system, for its entire constant-voltage service, or for each of the several districts into which the system may be divided, and shall file with this commission a statement as to the standard average voltage or average voltages adopted.

Every reasonable effort shall be made by the use of proper equipment and operation to maintain such voltage practically constant at all times. The suitability and adequacy of these service voltages may be determined at any time by this commission. The voltage maintained at the utility's main service terminals⁴³ as installed for individual consumers or groups of consumers shall be reasonably constant as follows:

(1) For service rendered under a lighting contract or primarily for lighting purposes the voltage between 6 o'clock p. m. and 11 o'clock p. m. shall be within 5 per cent plus or minus of the standard adopted and the total variation of voltage from minimum to maximum during the hours above specified shall not exceed 7 per cent of the average voltage in cities and other incorporated places having a population in excess of 2,500, nor 9 per cent of the average voltage in all other places.

(2) For service rendered under a power contract or primarily for power purposes, the voltage variation shall not exceed 10 per cent above or 10 per cent below the standard average voltage at any time when the service is furnished.

(3) A greater variation of voltage than that specified above may be allowed when service is furnished directly from a transmission line or in a limited or extended area where consumers are widely scattered and the business done does not justify close voltage regulation. In such cases the best voltage regulation should be provided that is practicable under the circumstances. This clause refers particularly to individual consumers or small groups of consumers whose service from a transmission line is incidental, and does not refer to the voltage regulation in communities, cities, or towns for which the transmission line was primarily built.

(b) Variations in voltage in excess of those specified caused (1) by the operation of power apparatus on the consumer's premises, which necessarily requires large starting currents, (2) by the action of the elements, (3) by infrequent and *unavoidable* fluctuations of short duration due to necessary station or line operations, shall not be considered a violation of this rule.

(c) Utilities supplying power to one or more other electric utilities may make application to the commission for a specific ruling applicable to each particular case.

⁴³ The term "service terminal" refers to the point at which the utility's service connections terminate, at which point connection is made with the consumer's wiring and beyond which the utility has no responsibility.

CONNECTICUT.

RULE 6. Voltage variation.—(a) Each utility shall adopt a standard voltage or standard voltages, as may be required for its constant potential system, or for any subdivision into which the system may be divided, and shall maintain such voltage or voltages constant within reasonable limits. Variations in excess of the following limits may, at the discretion of the commission, and after investigation, be considered as unreasonable, due allowance being made for local conditions.

(1) For service rendered under a lighting contract, or primarily for lighting purposes, between sunset and 11 o'clock p. m., 5 per cent above or 3 per cent below standard voltage for periods longer than one minute in each instance.

(2) For service rendered under a power contract, or primarily for power purposes, 10 per cent above and 10 per cent below standard voltage for periods longer than one minute in each instance, at any time when the service is furnished.

DISTRICT OF COLUMBIA.

SECTION 15. Voltage.—On all constant potential systems, electrical corporations shall maintain at the consumer's service cut-out a standard voltage within the following percentages: 3 per cent from the standard during lighting hours and 10 per cent from the standard during other hours on systems primarily for lighting; 10 per cent from the standard on power circuits (trolley circuits excluded).

Variations in voltage of momentary duration which do not occur successively and variations caused by the operation of apparatus on the consumer's premises in violation of the rules of the electrical corporation or due to other causes beyond the control of the corporation shall not be considered a violation of this section.

ILLINOIS.

RULE 18. Voltage regulation.—(a) Each utility supplying electrical energy from a constant-potential system shall adopt a standard service voltage for each locality supplied from such system, and shall make every reasonable effort by the use of proper equipment and operation to maintain the service voltage at approximately such standard value at all times during which service is supplied.

(b) For service rendered under a lighting contract, or primarily for lighting purposes, voltage variations between sunset and 11 o'clock p. m., as measured at any consumer's service terminals shall not exceed 5 per cent above or 4 per cent below the standard service voltage for that locality for a longer period than one minute in each instance. At other periods the variation shall not exceed 10 per cent above or below the standard.

(c) For service rendered under a power contract, or primarily for power purposes, voltage variations as measured at any consumer's service terminals shall not exceed 10 per cent above or below the standard service voltage for that locality, for a longer period than one minute in each instance.

(d) Variations of voltage in excess of those specified above caused (1) by operations of the consumer in violation of his contract or of the rules of the utility, (2) by the operation of power apparatus on the consumer's premises which necessarily require large starting currents, (3) by infrequent and unavoidable fluctuations of short duration due to station operation, or (4) by the action of the elements, shall not be considered an infraction of this rule.

INDIANA.

RULE 23. Standard voltage and permissible voltage variation.—(a) Each utility shall adopt a standard average voltage or standard average voltages, as may be required by its distribution system for its entire constant voltage service, or for each of the several districts into which the systems may be divided, and shall file with the com-

mission a statement as to the standard average voltages adopted. The voltage maintained at the utility's main service terminals shall be reasonably constant, as follows:

(1) For service rendered under the lighting contract or primarily for lighting purposes, between sunset and 11 o'clock p. m., the voltage shall be within 5 per cent plus or minus of the standard adopted, and the total variation of voltage from minimum to maximum shall not exceed 6 per cent of the average voltage in cities and other incorporated places having a population in excess of 2,500, nor 8 per cent of the average voltage in all other places.

(2) For service rendered under a power contract or primarily for power purposes the voltage variation shall not exceed 10 per cent above or 10 per cent below standard average voltage at any time when the service is furnished.

(3) A greater variation of voltage than specified above may be allowed when service is supplied directly from a transmission line, or in a limited or extended area where consumers are widely scattered and the business done does not justify close voltage regulation. In such cases the best voltage regulation should be provided that is practicable under the circumstances.

(b) Variations in voltage in excess of those specified, caused (1) by the operation of power apparatus on the consumer's premises which necessarily requires large starting current, (2) by the action of the elements, and (3) infrequent and unavoidable fluctuations of short duration due to station operation, shall not be considered a violation of this rule.

(c) Utilities supplying power to one or more other electric utilities may make application to the commission for a ruling applicable to each case.

MARYLAND.

2. (a) Each utility supplying a constant potential service shall adopt standard supply voltage or voltages for its system, or larger divisions thereof, and every reasonable effort shall be made to maintain such voltage constant at all times during which service is supplied. The variation above or below standard voltage shall not exceed 6 per cent of such standard voltage at any time between sunset and 11 p. m. On power circuits and during other than lighting hours, the voltage shall not vary at any time more than 8 per cent from the standard (except in the case of power supplied from electric railway lines). In the case of special contracts for lighting or power service not connected with the principal distribution system of the utility, such service may be supplied under conditions of greater voltage variation when approved by the commission.

(b) Purely momentary variations due to the operation of existing consumers' installations lasting not more than one minute in each instance, shall not be considered a violation of this rule, provided such momentary variations do not occur with such frequency as to render the service to other consumers unsatisfactory.

NOTE.—Each utility should adopt, and file with the commission, rules governing the type and character of consumers' power installations and appliances thereafter permitted to be connected to the utility's system.

(c) Standard voltage is defined as that voltage which should be maintained on secondary bus lines or the distribution network, to which consumers' service lines are connected.

MICHIGAN.

49. *Standards of voltage.*—Each utility shall adopt definite standards of "normal" voltage, subject to the approval of the commission, as may seem desirable for all of the territory served or for each of several districts or classes of service into which the system may be divided, and shall file with the commission a statement showing the standards of voltage so adopted, in accordance with the regulations prescribed by the commission.

50. For service rendered primarily for incandescent lighting purposes in incorporated cities, towns, and villages having a population greater than 2,000, the voltage at the utility's service terminals during the hours between sunset and 12 o'clock midnight shall be maintained within 5 per cent above or 3 per cent below the standard voltage adopted, and in all other places within 7 per cent above or 5 per cent below the standard voltage: *Provided, however,* That variations in voltage greater than those specified, which are caused by the operation of machines requiring large starting currents or by the action of the elements, and such momentary and unavoidable fluctuations as may naturally be due to station operation, shall not be considered a violation of this rule.

51. In cases where the above limits in voltage variation are for special reasons difficult of attainment or application, as when one utility supplies energy to one or more other utilities for distribution, then application may be made to the commission for a special ruling.

MISSOURI.

RULE 27. Each utility supplying energy from a constant potential system shall adopt standard service voltages for the entire system or each subdivision thereof, and every reasonable effort shall be made by the use of proper equipment and operation to maintain such voltage practically constant at all times. The suitability and adequacy of these service voltages may be determined at any time by the commission.

For lighting service, the variation in voltage, for periods exceeding one minute, as measured at the consumer's cut-out, shall not exceed 3 per cent above and 5 per cent below standard service voltage for that locality between sunset and 11 p. m. and 5 per cent above and 10 per cent below between 11 p. m. and following sunset.

For power service, the variation in voltage for periods exceeding one minute shall not at any time be greater than 10 per cent above or below standard service voltage for that locality at the consumer's cut-out.

Utilities will not be held responsible for variations in service voltage caused by the operation of apparatus by the consumer in violation of the utility's rules or by the action of the elements, or causes beyond the utility's control.

NOTE.—This rule may be waived for any particular consumer by special written agreement other than the regular service contract or application, provided that such an arrangement does not affect the quality of the service to other consumers.

MONTANA.

RULE 5. Voltage.—(a) Each utility shall adopt a standard average voltage or standard average voltages, as may be required by its distribution system for its entire constant voltage service, or for each of the several districts into which the systems may be divided, and shall file with the commission a statement as to the standard average voltages adopted. The voltage maintained at any consumers cut-out shall be reasonably constant, as follows:

(1) For service rendered under lighting contract or primarily for lighting purposes, between sunset and 11 o'clock p. m. the voltage shall be within 6 per cent plus or minus of the standard adopted, and the total variation of voltage from minimum to maximum shall not exceed 7 per cent of the average voltage in cities and towns having a population of 2,500 or more, nor 8 per cent of the average voltage in all other places.

(2) For service rendered primarily for power purposes the voltage variation shall not exceed 10 per cent above or below the standard voltage at any time when the service is required.

(3) A greater variation of voltage than specified above may be allowed when service is supplied directly from a transmission line, or in a limited or extended area where consumers are widely scattered and the business done does not justify close voltage regulations.

(b) Variations in voltage in excess of those specified, caused:

(1) By the large starting current requirement of power apparatus on consumer's premises.

(2) By the action of the elements.

(3) Infrequent and unavoidable fluctuations of short duration due to station operation, shall not be considered a violation of this rule.

NEVADA.

RULE 23. Each company supplying electrical energy on constant potential systems shall adopt and maintain a standard average value of voltage as measured at any consumer's cut-out, which shall remain constant from day to day, and varying during any one day by an amount not more than 6 per cent of the minimum value.

NEW HAMPSHIRE.

RULE 14. Each utility which in any year shall have sold more than 50,000 kilowatt-hours, or have more than 50 consumers, shall adopt a standard voltage for the entire constant potential system (or major divisions thereof approved by the commission), and shall maintain the voltage within 3 per cent below and 5 per cent above, such standard on all lighting circuits during lighting hours, and on power circuits and on lighting circuits during other than lighting hours within 10 per cent of such standard. All other utilities shall maintain their voltage regulation on all constant potential lighting circuits during lighting hours so that the maximum voltage furnished any consumer shall not be more than 10 per cent above the minimum.⁴⁴

NEW JERSEY.

No. 6. Each utility supplying electrical energy on constant potential system shall adopt and maintain an average value of voltage as measured at any customer's cut-out, and the fluctuations as measured by a standardized indicating voltmeter shall not vary between sunset and 11 p. m. for periods exceeding five minutes more than 3 per cent above nor more than 3 per cent below the standard voltage for said location in force at the time; provided, however, that variations in pressure caused by the operation of apparatus on customers' premises in violation of the utility rules, the action of the elements, or other causes beyond the utility's control shall not be considered a violation of this provision.

NORTH DAKOTA.

RULE 23. *Standard voltage and permissible voltage variation.*—(a) Each utility shall adopt a standard average voltage or standard average voltages, as may be required by its distribution system for its entire constant voltage service, or for each of the several districts into which the systems may be divided, and shall file with the commission a statement as to the standard average voltages adopted. The voltage maintained at the utility's main service terminals shall be reasonably constant, as follows:

(1) For service rendered under the lighting contract or primarily for lighting purposes, between sunset and 11 o'clock p. m., the voltage shall be within 5 per cent plus or minus of the standard adopted, and the total variation of voltage from minimum to maximum shall not exceed 10 per cent of the average voltage in cities and

⁴⁴ The fluctuations in voltage permitted by this rule may upon first consideration appear to be excessive, but in view of the conditions existing in many of the States, a more exacting requirement at this time might work undue hardship upon some of the utilities. A closer regulation may be expected to be practical in the future. It may be that some utilities can not immediately meet the requirements of the rule as now made, since such requirements may involve the redesign and reconstruction of distribution systems, or the installation of regulating devices. In any case application may be made to the commission for a temporary suspension, or a modification of the rule to meet the reasonable requirements of the particular situation, and in such case the commission will make investigation and will take such action as may in fact be reasonably necessary. Momentary fluctuations in voltage resulting from the proper operation of the plant shall not be considered a violation of this rule.

other incorporated places having a population in excess of 2,500, nor 8 per cent plus or minus of the average voltage in all other places.

(2) For service rendered under a power contract or primarily for power purposes, the voltage variation shall not exceed 10 per cent above or 10 per cent below standard voltage at any time when the service is furnished.

(3) A greater variation of voltage than specified above may be allowed when service is supplied directly from a transmission line, or in a limited or extended area where consumers are widely scattered and the business done does not justify close voltage regulation.

In such cases the best voltage regulation should be provided that is practicable under the circumstances.

(b) Variations in voltage in excess of those specified, caused (1) by the operation of power apparatus on the consumer's premises which necessarily requires large starting current, (2) by the action of the elements, and (3) infrequent and unavoidable fluctuations of short duration due to station operation, shall not be considered a violation of this rule.

(c) Utilities supplying power to one or more other electric utilities, may make application to the commission for a ruling applicable to each case.

OKLAHOMA.

RULE 26. *Standard voltage and permissible voltage variation.*—(a) Each utility shall adopt a standard average voltage or standard average voltages, as may be required by its distribution system for its entire constant-voltage service, or for each of the several districts into which the systems may be divided, and shall file with the commission a statement as to the standard average voltages adopted. The voltage maintained at the utility's main service terminals as installed for each consumer or group of consumers shall be reasonably constant, as follows:

(1) For service rendered under a lighting contract or primarily for lighting purposes, between sunset and 11 o'clock p. m. the voltage shall be within 5 per cent plus or minus of the standard adopted, and the total variation of voltage from minimum to maximum shall not exceed 6 per cent of the average voltage in cities and other incorporated places having a population in excess of 2,500, nor 8 per cent of the average voltage in all other places.

(2) For service rendered under a power contract or primarily for power purposes, the voltage variation shall not exceed 10 per cent above or 10 per cent below standard average voltage at any time when the service is furnished.

(3) A greater variation of voltage than specified above may be allowed when service is supplied directly from a transmission line, or in a limited or extended area where consumers are widely scattered and the business done does not justify close voltage regulations. In such cases the best voltage regulation should be provided that is practicable under the circumstances.

(b) Variation in voltage in excess of those specified, caused (1) by the operation of power apparatus on the consumer's premises which necessarily requires large starting currents, (2) by the action of the elements, and (3) infrequent and unavoidable fluctuations of short duration due to station operation, shall not be considered a violation of this rule.

(c) In no event shall the utility be penalized for departure from the standards above set until it has had reasonable time after receiving written notice from the consumer or consumers affected, to investigate and make such corrections as are necessary to meet the requirements of this rule.

OREGON.

RULE 25. (a) Every electric utility shall adopt a standard voltage for the entire constant potential system in every city served by it having a population of 1,500 or

more, or, with the approval of the commission, may divide its distributing system in such city into districts and adopt a standard voltage for each such district. Notice of the adoption of such standard voltage shall be given by the utility to the commission. Except as may be caused by the operation of apparatus by the customer in violation of the utility's rules, or by the action of the elements or causes beyond the utility's control, every electric utility shall maintain the voltage constant in every such city so that the same shall not vary for periods exceeding five minutes more than the following amounts:

1. Lighting circuits: Between sunset and 11 p. m., more than 3 per cent above and 5 per cent below the standard voltage for such locality.
 2. Lighting circuits: Between 11 p. m. and the following sunset, more than 5 per cent above and 10 per cent below such standard voltage.
 3. Other circuits: More than 10 per cent above or below such standard voltage.
- (This rule may be waived by the customer by special agreement, separate from his service contract or application, particularly referring to this rule.)

PENNSYLVANIA.

No. 2. *Voltage variation.*—Each utility supplying electrical energy from a constant voltage system shall adopt standard service voltages for such system, the suitability and adequacy of which voltages may be determined at any time by the commission, and every reasonable effort shall be made to maintain such voltage practically constant at all times during which service is supplied. For service rendered under a lighting contract, or primarily for lighting purposes, the variations of voltages as measured at the service terminals shall not exceed 5 per cent plus or minus of the standard service voltage for that locality for a longer period than one minute at each instance, at any time during which service is supplied. For service rendered under a power contract, or primarily for power purposes, voltage variations as measured at the service terminals shall not exceed 10 per cent, plus or minus of the standard service voltage for that locality for a longer period than one minute at each instance:

Provided, first, That this limit of 10 per cent, shall not apply to power supplied from direct current trolley wires; and second, that a utility may, if satisfactory to and approved by the commission, furnish service under conditions of greater voltage variations, (a) upon filing with the commission a copy of all existing contracts containing a provision for service with such greater variations of voltage, or, (b) upon filing with the commission a copy of all existing contracts which do not contain a provision for such greater variations in voltage, together with a statement in each case of the variations in voltage existing in the service rendered under each said contract, and (c) upon filing with the commission a copy of all contracts made hereafter which contemplate service under conditions of greater voltage variations, and which shall in each case henceforth contain a clause stating the probable variations in voltage that will occur in the service rendered under said contract: And provided further, that such greater variations in the voltage shall not result in unreasonable discrimination in favor of or against any consumer.

Variations of voltage in excess of those specified above, caused by the operation of the consumer in violation of his contract or the rules of the utility, or for causes beyond the control of the utility, shall not be considered a violation of this rule.

SOUTH CAROLINA.

Standard voltage.—Each utility shall adopt standard average voltages for its different classes of constant voltage service. The voltage maintained at the utility mains shall at all times be reasonably constant, and the variations in voltage from the average shall in no case exceed the limitations as prescribed by good practice for such classes of service.

For service rendered for lighting purposes plus or minus variations from the standard adopted, should not exceed 6 per cent, for service rendered for power, or primarily for power purposes, the voltage variations should not exceed 10 per cent above or below the standard average voltage.

A greater variation of voltage than specified above may be allowed when service is supplied directly from the transmission line, or in a limited or extended area where consumers are widely scattered, and the business done does not justify close voltage regulation. In such cases the best voltage regulation should be provided that is practicable under the circumstances.

Variations in the voltage in excess of those specified, caused by the operation of power apparatus on consumers' premises, which necessarily requires large starting current by the action of the elements, and by infrequent and unavoidable fluctuations of short duration due to station operation, shall not be construed a violation of this rule.

WEST VIRGINIA.

RULE 24. *Standard voltage and permissible voltage variation.*—Every utility supplying electrical energy shall maintain a standard voltage on their constant potential system and as measured at the consumer's cut-out, and under the following conditions:

On circuits primarily for lighting a variation of 5 per cent above and 3 per cent below standard will be permitted, but not to exceed such variation longer than one minute at each instance.

On circuits used for power only or for both lighting and power purposes, a variation of 10 per cent either way from standard will be permitted, but such variation shall not exceed 10 per cent longer than one minute at each instance.

Variations in voltage in excess of those specified, caused by the operation of apparatus on the consumer's premises in violation of the utility's rules, or the action of the elements, shall not be considered a violation of the rule.

WISCONSIN.

No. 25. *Voltage variation.*—Each electric utility operating in a city having a population of 1,500 or more shall adopt a standard voltage for the entire constant potential system and shall maintain the voltage within 3 per cent of such standard on all lighting circuits during lighting hours; on power circuits and during other than lighting hours the voltage shall be maintained within 10 per cent of the standard. All other electric utilities shall maintain their voltage regulation on all constant potential circuits during lighting hours so that the maximum voltage furnished any consumer shall not be more than 6 per cent above the minimum voltage at that consumer's cut-out.

IV. SUGGESTED RULES FOR THE REGULATION OF ELECTRIC SERVICE BY STATE PUBLIC UTILITY COMMISSIONS.

1. INTRODUCTORY STATEMENT.

In the adoption of rules for electric service by a large number of the States, the bureau has been represented at public hearings or has made written suggestions at the request of the State commission considering the matter. By conference and correspondence with commissions, utility operators, and committees of various engineering and technical associations, much information from many sources has been collected. In order to make this information available to regulating bodies in a concise and definite form, certain rules and regulations are here proposed (see pp. 218-233) embodying the various points discussed in the first sections of this circular, and setting forth what is considered accepted good practice in electric utility regulation. The rules proposed are the result of a very careful study of all existing commission rules, and of accepted good practice throughout the country.

Certain provisions with reference to electric plant and maintenance are incorporated in the rules here proposed. In Arizona, California, Connecticut, Idaho, Illinois, Iowa, Kansas, Michigan, Nebraska, Nevada, North Carolina, North Dakota, Oklahoma, Oregon, Pennsylvania, Tennessee, Utah, and Wisconsin general safety and construction rules or recommendations are in force, based largely, in most cases, on the National Electrical Safety Code, published originally by the Bureau of Standards as Circular 54, and in revised editions as Handbook No. 3 (the latest edition is the third, issued October 31, 1920).⁴⁵ In several States laws providing for certain construction and safety requirements in considerable detail are in effect. In a few States labor and industrial commissions, either in cooperation with the public utilities commission or independently, have promulgated rules and regulations with reference to electrical safety standards. In the service rules here proposed a few safety requirements are included, applicable in cases where general electrical safety and construction rules are not yet adopted.

It should be specially noted that the suggested rules are drawn up to apply generally in all States. Modifications must accord-

⁴⁵ The National Electrical Safety Code was approved as an American standard by the American Engineering Standards Committee in July, 1922.

ingly be made on account of varying provisions of State laws and local practice. The rules here given apply, for example, to municipally owned utilities, but in a number of the States municipal utilities are not subject to regulation by the commission. Meter accuracy is fixed by law in several States (see Appendix 2, Table 1), the percentage of allowable error ranging from 2 to 5 per cent.

At this time (July, 1923) rules and regulations for public utilities furnishing electric service are in force in the States listed below. A complete list of all State rules, including both service rules and safety rules, will be found on pages 44-51. The State lists here given refer to: Table I, Rules covering standards of service; Table II, Rules for safety and construction; Table III, States in which no service rules have so far been adopted; and Table IV, States where there seems to be no jurisdiction over electric service and safety by public service or industrial commission.

TABLE I.—States Having Rules Regulating Electric Service.

Arizona.	Michigan.	Oklahoma.
California. ⁴⁶	Missouri.	Oregon.
Colorado.	Montana.	Pennsylvania.
Connecticut.	New Hampshire.	South Carolina.
District of Columbia.	New Jersey.	Washington.
Illinois.	Nevada.	West Virginia.
Indiana.	New York.	Wisconsin.
Maryland.	North Dakota.	

In Massachusetts the laws of the State cover many of the items contained in commission service rules in other States.

TABLE II.—States Having Rules for Safety of Operation and Construction.

Arizona.	Montana.	Oklahoma.
California.	Nebraska.	Oregon.
Idaho.	Nevada.	Pennsylvania.
Illinois.	New York.	Tennessee.
Indiana.	North Carolina.	Utah.
Iowa.	North Dakota.	Washington.
Kansas.	Ohio.	Wisconsin.
Michigan.		

The regulating commissions in the States listed in the following table have not yet adopted rules for electric service, although the commissions apparently have jurisdiction over electric utilities.

⁴⁶ The rules in California are concerned only with deposits required of customers, and extensions. There are no State-wide rules covering all phases of electric service.

TABLE III.—States in Which no Electric-Service Rules Have Been Adopted.

Maine.	Alabama.	Kansas.
Rhode Island.	Louisiana.	Nebraska.
Vermont.	Arkansas.	Wyoming.
Virginia.	Tennessee.	Utah.
North Carolina.	Ohio.	Idaho.
Georgia.	Iowa.	

It appears that in the following States there is either no commission regulating public utilities at all, or its jurisdiction does not include electric-light and power companies' service.

TABLE IV.—States Exercising no Jurisdiction over Electric Service.

Delaware.	Texas.	Kentucky.
Florida.	Minnesota.	South Dakota.
Mississippi.	New Mexico.	

2. PROPOSED COMMISSION RULES FOR ELECTRIC SERVICE.

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STATUTORY REQUIREMENTS AND GENERAL PROVISIONS:

RULE 1. Definitions and general provisions—

- (a) Definitions.
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- (c) Customers to comply with rules of utility.

OPERATION AND MAINTENANCE:

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RULE 4. Pole identification—

- (a) Each pole to be marked.
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- (a) Suggested places.
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- (b) Facilities to be provided.
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 - 1. Instruments and meters.
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METERS—Continued.

RULE 9. Accuracy requirements of watthour meters—

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- (a) All tests to be made in place of service.
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RULE 12. Installation tests—

- (a) Tests before installation.
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RULE 13. Periodic tests of watthour and demand meters—

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- (a) Record of meters.
- (b) Record of tests.
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INFORMATION TO CUSTOMERS:

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RULE 19. Incandescent lighting.

RULE 20. Information as to kinds of service.

RULE 21. File of rate schedules, rules and regulations—

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- (b) Copy of commission rules to be public.
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2. Power service.
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RULE 23. Standard frequency.

RULE 24. Voltage surveys and records.

RECORDS:

- RULE 25.** Station instruments and meters.
- RULE 26.** Station records and interruptions of service.
- RULE 27.** Record of complaints as to service.

CHARGES, DEPOSITS, AND REFUNDS:

- RULE 28.** Meter rentals.
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 - (a) Fast watthour meters.
 - (b) Slow watthour meters.
- RULE 30.** Deposits:
 - (a) Cash deposit may be demanded.
 - (b) Records of deposits to be kept.
 - (c) Receipt to be given.
 - (d) Lost deposit receipts.
- RULE 31.** Accidents:
 - (a) Record to be kept.
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**RULES AND REGULATIONS PRESCRIBING STANDARDS FOR
ELECTRIC SERVICE AND PROVIDING FOR THE TESTING
OF METERS AND OTHERWISE REGULATING THE SERV-
ICE OF ELECTRIC UTILITIES.**

STATUTORY REQUIREMENTS AND GENERAL PROVISIONS.

[Insert here sections of the statutes under which the rules are promulgated.]

Rule 1. Definitions and general provisions.— (a) In the interpretation of these rules, the word “commission” shall be taken to mean the Public Service Commission of ———; the word “utility” shall be taken to mean any person, firm, corporation, or municipality engaged in the business of supplying electrical energy to the public; and the word “customer” shall be taken to mean any person, firm, corporation, municipality, or other political subdivision of the State, supplied by any such utility.

(b) The adoption of these rules and regulations shall in no way preclude the commission from altering or amending the same in whole or in part, after due notice and public hearing, or from allowing other or requiring additional service, equipment, facility, or standards, either upon complaint or upon its own motion, or upon the application of any utility. These rules shall not in any way relieve any utility from any of its duties under the laws of this State.

(c) Any utility may decline to serve a customer or prospective customer until he has complied with the State and municipal regulations on electric service and the reasonable rules and regulations of the utility furnishing the service.

OPERATION AND MAINTENANCE.

Rule 2. Adequacy of service.—(a) Each utility shall, so far as practicable, have and maintain its entire plant and system in such condition as will enable it to furnish safe, adequate, and continuous service within its hours of operation.

(b) Each utility shall file with the commission annually a statement regarding its plant, equipment, and facilities, in such form as the commission may require.

Rule 3. Accepted good practice.—The generating and distributing system, including: (a) Generating equipment; (b) transmission lines; (c) substations; (d) overhead system, poles, lines, transformers, etc.; (e) underground system, manholes, conduits, etc.; (f) street-lighting system; (g) service wires and attachments; (h) meters and instruments, shall be constructed, installed, operated, and maintained in accordance with accepted good practice.

Rule 4. Pole identification.—(a) Poles, towers, and other supporting structures on which are maintained electrical conductors shall be so constructed, located, marked, or numbered, as to facilitate identification by employees authorized to work thereon. Date of installation of such structures shall, where practicable, be recorded by the owner.

(b) Each utility shall, within — months after the adoption of these rules, mark each pole, post, or other structure used for supporting electrical conductors with (1) the initials of its name, abbreviation of its name, corporate symbol, or other distinguishing mark by which the owner of each such structure may be readily and definitely determined; (2) a number by which the location of each such structure may be described.

(c) In the case of two or more utilities jointly owning any such structure, the distinguishing mark of each utility shall be placed thereon, but not more than one number need necessarily be placed thereon.

(d) In the case of such structures erected upon private rights of way, or on the public highways, when of such character that the construction may be deemed to be a through line, such marks and numbers need be affixed only to every tenth structure.

(e) The requirements herein shall apply to all existing and future erected structures and to all changes in ownership.

(f) Every such utility shall file with the commission in duplicate, within — months after the adoption of these rules, a statement showing (1) the initials, abbreviation of name, cor-

porate symbol, or distinguishing mark; (2) the means of marking to be employed; (3) the method intended to be followed in numbering structures within the limits of cities, towns, or other built-up communities, and upon through lines.

Rule 5. Pole inspection.—Each pole, post, tower, or other structure used for the support or attachment of electrical conductors, guys, or lamps must be inspected by the utility owning or using it with reasonable frequency in order to determine the necessity for replacement or repair.

Rule 6. Grounding of low-potential circuits.—The rules currently in force contained in the National Electrical Safety Code regarding grounding of low-potential circuits shall be followed. Each utility shall adopt a plan whereby ungrounded circuits will be grounded in conformity with the safety code rules, and within ——— months after the adoption of these rules submit the said plan to the commission for approval.

METERS.

Rule 7. Location of meters.—(a) It is recommended that all meters hereafter installed on customers' premises should be located in the cellar or first floor, or as near as possible to the service, in a clean, dry, safe place, not subject to great variations in temperature, and on a support free from vibration. Where meters are installed out of doors, they should be protected from the weather.

(b) Meters should not be placed in coal or wood bins or on the partitions forming such bins, nor on any unstable partitions or supports. Unless unavoidable, meters should not be installed in attics, sitting rooms, bathrooms, bedrooms, show windows, or restaurant kitchens, over doors, over windows, or in any location where the visits of the meter reader or tester will cause annoyance to the customer.

(c) Meters should be easily accessible for reading, testing, and making necessary adjustments and repairs. When a number of meters are placed on the same meter board, the distance between centers should not be less than 15 inches for direct-current meters, and 10 inches for alternating-current meters. Each meter loop should be so tagged or marked as to indicate the circuit metered. Meters should preferably not be less than 4 feet nor more than 7 feet above the floor or a suitable permanent platform.

Rule 8. Meter-testing facilities and equipment.—(a) *Standardizing laboratory.*—Whenever any utility is maintaining or shall

hereafter establish and maintain a standardizing laboratory, periodic inspection by the commission will be made of the instruments and methods in use, and if instruments and methods are acceptable to the commission after such inspections, certification of meters and instruments for its own use and for other utilities may be made by such laboratory. Utilities not maintaining standardizing laboratories may obtain authorization from the commission to have certification of meters and instruments made for them by any approved standardizing laboratory.

(b) *Facilities and equipment.*—Each utility furnishing metered electric service shall, unless specifically excused by the commission, provide for and have available such meter laboratory, standard meters, instruments, and other equipment and facilities as may be necessary to make the tests required by these rules. Such equipment and facilities shall be acceptable to the commission, and shall be available at all reasonable times for the inspection of any authorized representative of the commission.

(c) *Test standards.*—1. Each utility furnishing metered electric service shall provide for and have available such portable indicating electrical testing instruments or watthour meters of suitable range and type for testing service watthour meters, demand meters, switchboard instruments, recording voltmeters, and other electrical instruments in use, as may be deemed necessary and satisfactory by the commission.

2. For testing the accuracy of portable watthour meters, commonly called “rotating standards,” and other portable instruments used for testing service meters, each utility, not specifically excused by the commission as provided for in section (b) of this rule, shall provide for and have available as reference or check standards suitable indicating electrical instruments, wattmeters, watthour meters, or any or all of them, hereafter called reference standards. Such standards may be of the service type of watthour meters, but, if so, such watthour meters shall be permanently mounted in the meter laboratory of the utility, and be used for no other purpose than for checking working rotating standards.

Reference standards of all kinds will be tested, and if necessary adjusted, by the commission at least once a year unless a standardizing laboratory is maintained as provided for in (a) of this rule.

3. All portable watthour meters (rotating standards) shall be compared with the reference standards at least once a week for

commutator types and once in two weeks for induction types during the time such portable testing standards are being regularly used. Unless accompanied by a calibration card, if such check shows any portable watthour meter (rotating standard) to be in error more than 1 per cent plus or minus at any load at which the standard will be used, the meter shall be tested, adjusted, and certified in the laboratory of the utility, or in some other approved laboratory, or by the commission. Each portable watthour meter (rotating standard) shall at all times be accompanied by a certificate or calibration card, signed by the proper authority, giving the date when it was last certified and adjusted. Records of certifications and calibrations shall be kept on file in the offices of the utility for a period of at least one year.

4. All portable indicating electrical testing instruments, such as voltmeters, ammeters, and wattmeters, when in regular use for testing purposes, shall be checked against suitable reference standards at least once in two weeks when continually in use, and if found appreciably in error at zero or in error by more than 1 per cent of full-scale value at commonly used scale deflections shall, unless accompanied by calibration card, be adjusted and certified in some approved laboratory or by the commission.

Rule 9. Accuracy requirements for service watthour meters.—

(a) *Initial and test adjustments.*—1. No watthour meter that has an incorrect register constant, test constant, gear ratio, or dial train, or that registers upon no load ("creeps") shall be placed in service or be allowed to remain in service without adjustment and correction. A meter in service creeps when, with all load wires disconnected, the moving element makes one complete rotation in five minutes or less.

2. No watthour meter that has an error in registration of more than plus 2 or minus 4 per cent at light load, or plus or minus 2 per cent at heavy load, shall be placed in service or allowed to remain in service without adjustment. Whenever on installation, periodic, or any other tests a meter is found to exceed any one of these limits it must be adjusted.

Light load shall be approximately 5 to 10 per cent of the rated capacity of the meter. Heavy load shall be not less than 60 per cent nor more than 100 per cent of the rated capacity of the meter.

3. Meters must be adjusted as closely as possible to the condition of zero error. The tolerances are specified to allow for necessary variations, and meters must not be adjusted to the tolerances allowable.

(b) *Average error.*—In tests made by the commission or utility, at the request of the customer, the average error of a meter shall be determined by one or the other of the following methods:⁴⁷

Method A.—Take one-fifth of the algebraic sum of (1) the error at light load, (2) three times the error at normal load, (3) the error at full-rated capacity.

In determining normal load the following percentages of the several classes of full-connected installations may be used:

	Per cent.
(a) Residence and apartment lighting.....	25
(b) Elevator service.....	40
(c) Factories (individual drive), churches, and offices.....	45
(d) Factories (shaft drive), theaters, clubs, hallways, entrances, and general store lighting.....	60
(e) Restaurants, pumps, air compressors, ice machines, and moving-picture theaters.....	70
(f) Sign and window lighting, blowers, and battery charging.....	100

Method B.—Take one-half the algebraic sum of (1) the error at light load, and (2) the error at heavy load.

Rule 10. Accuracy requirements for demand meters.—Demand meters must be adjusted to meet the following accuracy requirements on installation and after periodic or any other tests.

- (1) Curve-drawing instruments:

	Error shall not exceed—
Electrical element.....	2 per cent of full-scale deflection.
Timing element (rate).....	0.25 per cent.
- (2) Integrated-demand meters:

Electrical element.....	Tolerances specified in rule 9 for watt-hour meters.
Timing element.....	Where the timing element serves only to measure the demand interval, it should be adjusted if its rate is more than plus or minus 2 per cent in error. Where the timing element also serves to keep a record of the time of day at which the demand occurs, it should be adjusted if its rate is more than plus or minus 0.25 per cent in error.
- (3) Lagged-demand meters:

Electromagnetic type.....	2 per cent of full-scale deflection.
Thermal type.....	4 per cent of full-scale deflection.

Rule 11. Place and methods for meter testing.—(a) All tests on watt-hour meters and demand meters in service provided for in these rules shall be made in the place of permanent location on the customers' premises with approved testing apparatus and under the local conditions of operation, unless otherwise stated in any rule or allowed by special order of the commission.

⁴⁷ Note that one or the other, but not both methods, should be adopted in a State's rules.

(b) Watthour meters installed with instrument transformers or shunts shall be tested jointly with such transformers or shunts, unless the ratio and phase angle of the transformers and the resistance of the shunts have been previously determined within 10 years and are on file at the office of the utility for use in calculating results of tests. All such calibration tests must have been made by a laboratory of recognized standing, or by the utility, using apparatus and methods satisfactory to the commission.

Rule 12. Installation tests.—(a) All watthour and demand meters shall be tested and adjusted to register accurately to within the limits specified in rules 9 and 10 before installation, or within 60 days after installation, provided that all direct-current watthour meters shall be tested and adjusted within 60 days after installation in their place of service.

(b) Watthour meters that are to be used on circuits of low-power factor (lagging current) shall be tested and adjusted before installation to register correctly to within 2 per cent plus or minus at a power factor of approximately 50 per cent, and at approximately 100 per cent of rated current.

Rule 13. Periodic tests of watthour and demand meters.—(a) All types of watthour meters and demand meters installed upon customers' premises shall be periodically tested according to the schedules below, and in accordance with rules 9 and 10.

1. Schedule for Periodic Testing of Watthour Meters and Curve-Drawing and Integrated-Demand Meters.

	Rated capacity of meter.	To be tested at least once in every—
Direct-current meters	Exceeding 500 amperes.....	6 months.
	500 amperes to 50 amperes, inclusive.....	18 months.
	25 amperes and less	30 months.
Alternating-current meters:		
(a) Single phase.....	Exceeding 25 amperes.....	24 months.
	25 amperes and less.....	48 months.
(b) Polyphase.....	Exceeding 50 kilovolt-amperes.....	12 months.
	50 kilovolt-amperes and less.....	24 months.

2. Schedule for Periodic Testing of Lagged Demand Meters (Class III A and B).

	To be tested at least once in every—
(a) Class III A. Proportional timing.....	4 years.
(b) Class III B. Exponential timing.....	5 years.

(b) All watthour and demand meters in service on and after ———, for which there is on file at the utility's office no record of test made within the period of time specified for that class and

rating of meter in (a) above, shall be tested as soon as possible. In no case shall the time subsequent to ——— exceed the period of test for meters of that class and rating as specified in this rule.

Rule 14. Tests upon request of customer.—Each utility shall, without charge, make a test of the accuracy of registration of a meter upon the request of a customer, provided that the customer does not request such test more frequently than once in 12 months. A written report, giving results of such test, shall be made to the customer, and a copy of this report and a complete record of such test shall be kept on file at the office of the utility for a period of at least three years.

Rule 15. Tests by commission.—(a) Upon written application by any customer to the commission a test will be made on the customer's meter by an inspector employed by the commission, such test to be made as soon as practicable after receipt of the application. For such test a fee as scheduled below shall be paid by the customer at the time application is made for the test. The utility owning the meter will be notified that such test is to be made, and should have a representative present to open the meter, assist in the test, and adjust and seal the meter after the test. If the meter is found to be correct or slow, this fee will be retained. If the meter is found to be more than 4 per cent fast; that is, has an average error in excess of 4 per cent as determined by the method specified in rule 9, the amount of the fee will be refunded to the customer and collected from the utility owning the meter.

(b) Upon application to the commission by any utility, the commission will make a test on any of the utility's meters upon payment of the scheduled fee.

Schedule of Fees.

[Suitable schedule of fees to be inserted here.]

Rule 16. Meter records and reports.—(a) Each utility furnishing metered service shall keep a record (1) of the names and addresses of all its customers with an identifying number of the meter or meters used by each of them and (2) of all its meters, showing dates of installation and removal.

(b) A complete record shall be kept by each utility of all tests on watthour meters installed on customers' premises. Such record shall include: An identifying number of meter; type and capacity of meter; constants of the meter; date and kind of test made; the reading of the meter before making the test; the error (or

per cent accuracy) at heavy load and at light load as found at each test, and the accuracy of adjustment as left after each test.

(c) The meter records of each utility shall be available for examination at any time by the commission, its engineers, and inspectors. The record of tests of each meter shall be continuous for at least two periodic tests and in no case for less than three years.

(3) Each utility shall report to the commission within ——— after the adoption of these rules, and yearly thereafter, the types and number of meters in its service. Each utility shall file with the commission such reports of meter tests as the commission may from time to time require.

INFORMATION TO CUSTOMERS.

Rule 17. Information as to reading of meters.—Each utility supplying metered service shall adopt some method of informing its customers how watthour meters are read, either by printing on bills a description of the method of reading meters, by distributing booklets or folders describing the method, or by notice to the effect that the method will be explained on application.

Rule 18. Information on bills.—Bills rendered periodically by each utility supplying metered service shall show, in addition to the net amount due, the dates on which the readings were taken, the meter readings, when requested by the customer, and all other essential facts upon which the bill is based.

Rule 19. Incandescent lighting.—It is recommended (a) that each utility supplying electrical energy for incandescent lighting should upon request render its customers reasonable assistance in securing incandescent lamps and other appliances best adapted to the service furnished; (b) that lamps furnished by utilities to customers without charge (free renewals), or at prices less than open-market prices, should be of such efficiency in lumens per watt when used on the utility's circuits of standard nominal voltage as defined in rule 22, so that customers may obtain their lighting service under the most favorable conditions practicable under the rate schedule.

Rule 20. Information as to kinds of service.—Each utility shall, on request of any customer or prospective customer furnish a statement of the kind or kinds of service available, giving the standard nominal voltages, nature of current, and, if alternating current, the frequency and number of phases. Where one class of service is available through only a part of the district served,

this shall be stated in connection with any such application. Where service is available only at certain times of day or night, full information shall be readily available to all prospective customers or their representatives.

Rule 21. File of rate schedules, rules, and regulations of the utility and of the commission.—(a) Copies of all schedules of rates for service, forms of contracts, and charges for service connections and extensions of lines shall be filed by each utility in the office of the commission. Complete schedules, contract forms, rules and regulations, etc., as filed with the commission, shall also be on file in the local office of the utility, and shall be open to the inspection of the public.

(b) It is recommended that a copy of the rules and regulations for electric service as published and furnished by the Public Service Commission be on file and open to the inspection of the public.

(c) It is recommended that the attention of the public be called to these files of schedules, rules, and regulations, by placing a suitable placard in the office of the utility.

VOLTAGE AND FREQUENCY.

Rule 22. Standard nominal voltage and permissible voltage variation.—(a) Each utility shall adopt a standard nominal voltage or standard nominal voltages, as may be required by its distribution system for its entire constant-voltage service, or for each of the several districts into which the systems may be divided, and shall file with the commission a statement as to the standard nominal voltages adopted. The voltage maintained at the utility's main service terminals, as installed for each customer or group of customers, shall be reasonably constant, as follows:

1. For service rendered under a lighting contract or primarily for lighting purposes, between sunset and 11 o'clock p. m., the variation in voltage shall be not more than 5 per cent plus or minus of the nominal voltage adopted, and the total variation of voltage from minimum to maximum shall not exceed 6 per cent of the nominal voltage in cities and other incorporated places having a population in excess of 2,500, nor 8 per cent of the nominal voltage in all other places.

2. For service rendered under a power contract or primarily for power purposes, the voltage variation shall not exceed 10 per cent above or 10 per cent below standard nominal voltage at any time when the service is furnished.

3. A greater variation of voltage than specified above may be allowed when service is supplied directly from a transmission line, or in case of emergency service, or in a limited or extended area where customers are widely scattered and the business done does not justify close voltage regulation. In such cases the best voltage regulation should be provided that is practicable under the circumstances.

(b) Variations in voltage in excess of those specified, caused (1) by the operation of power apparatus on customers' premises which necessarily requires large starting currents, (2) by the action of the elements, and (3) infrequent and unavoidable fluctuations of short duration due to station operation, shall not be considered a violation of this rule.

(c) Utilities supplying power to one or more other electric utilities may make application to the commission for a ruling applicable to each case.

Rule 23. Standard frequency.—Each utility supplying alternating current shall adopt a standard frequency, and shall file with the commission a statement as to the standard adopted. The utility should maintain this frequency to within 5 per cent above and 5 per cent below the standard, at all times.

Rule 24. Voltage surveys and records.—Each utility shall provide itself with one or more portable indicating voltmeters, and each utility serving more than 250 customers shall have one or more recording (curve drawing) voltmeters. These instruments shall be of a type and capacity suited to the voltage supplied. Each utility shall make a sufficient number of voltage surveys to indicate the character of the service furnished from each center of distribution, and to satisfy the commission upon request of its compliance with the voltage requirements; and those having curve-drawing voltmeters shall keep at least one instrument in continuous service at the plant, office, or some customer's premises. All voltmeter records shall be available for inspection by the commission, or anyone authorized by the commission, for a period of at least one year.

Rule 25. Station instruments and meters.—Each utility shall install such instruments and meters as may be necessary to obtain a daily record of the load and a monthly record of the output of its plants. Each utility purchasing electrical energy shall install such instruments and meters as may be necessary to

furnish full information as to the monthly purchases, unless the utility supplying the energy has already installed such instruments and meters from which the necessary information can be obtained.

Rule 26. Station records and interruptions of service.—Each utility shall keep a record of (1) the time of starting and shutting down power-station equipment and feeders; (2) the indication of sufficient switchboard instruments to show the characteristics of the load; and (3) all interruptions of service upon the entire system or major divisions of its system, and include in such record time, duration, and, as far as practicable, the cause of each interruption. The record shall be available for inspection at any time within six months by representatives of the commission.

Rule 27. Records of complaints as to service.—Each utility shall keep records of all complaints received at its offices in regard to service, which records shall include the name and address of the customer, the date, nature of complaint, and the remedy. These records shall be available for inspection at any time within six months by representatives of the commission.

CHARGES, DEPOSITS, AND REFUNDS.

Rule 28. Meter rentals.^a—No rental shall be charged by any utility for any meter installed by it, which is used by the utility as the basis for rendering its bills. Where additional meters furnished by the utility are to be used as submeters or for the convenience of the customer, a charge for such meters may be made in accordance with a schedule approved by the commission.

Rule 29. Refunds and prorated bills.—(a) *Fast watthour meter.*—Whenever a watthour meter in service is found upon test, made by the utility or the commission at the request of the customer, to have a positive average error—that is, is fast—in excess of 4 per cent, the company shall refund to the customer an amount equal to the excess charged for the kilowatthours incorrectly metered, for a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months.

(b) *Slow watthour meter.*—When a watthour meter is found to have a negative average error—that is, is slow—in excess of 4 per cent, in tests made at the request of the customer, the

^a This rule does not preclude the cost and maintenance of the meter forming one of the elements to be covered in a "service charge," if the rate schedule filed with the commission includes such a charge.

company may make a charge to the customer for the kilowatt-hours incorrectly metered, for a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months. If a meter is found not to register for any period, the company shall estimate and charge for the kilowatthours used by averaging the amounts registered over similar periods, preceding or subsequent thereto, or over corresponding periods in previous years.

Rule 30. Deposits.—(a) A utility may require from any customer or prospective customer a cash deposit of an amount not less than \$——. Interest thereon at the rate of — per cent per annum, payable upon the return of the deposit,^a shall be paid by the utility to each customer making such deposit, for the time such deposit was held by the utility and the customer was served.

(b) Each utility having on hand deposits from customers or hereafter receiving deposits from customers shall keep records to show: (1) The name of each customer making a deposit; (2) the premises occupied by the customer when making the deposit; (3) the amount and date of making the deposit; and (4) a record of each transaction, such as payment of interest, interest credited, etc., concerning such deposit.

(c) Each utility shall issue to every customer from whom a deposit is received a certificate of deposit.

(d) Each utility shall provide reasonable ways and means so that a depositor who makes application for the return of his deposit or any balance to which he is entitled, but is unable to produce the original certificate of deposit or receipt, shall not be deprived of his deposit or balance.

Rule 31. Accidents.—(a) Each utility shall keep a record of and promptly furnish to the commission full reports of all accidents happening in, or about, or in connection with the operation of its plants, stations, property, and equipment wherein any person shall have been killed or seriously injured.

(b) It is expected that all reasonable care will be exercised by each utility to reduce the life hazard (1) to which employees are subjected in working in stations and substations and on overhead and underground lines, (2) to which the utility's customers may

^a Many commission rules add: "Or annually upon demand by the customer."

be subjected by the introduction of its wires into the premises of the customers, (3) to which the general public may be subjected by the presence of overhead wires in the public streets and ways.

Rule 32. Extensions of lines.—Each utility shall file with the commission all rules for extensions of lines which involve payments or deposits by the customer, in addition to those provided for in the regular filed rate schedules of the utility.

V. THE REGULATION OF ELECTRIC SERVICE BY CITY ORDINANCE.

Few American cities have regulatory ordinances for electric service, although most cities have ordinances regulating electric wiring, based almost entirely on the National Electrical Code.

Circular letters were sent to a large number of city electricians, electrical inspectors, and city clerks, in order to determine in a general way what ordinances are to-day in force in cities located in States which do not have regulation by a State public service commission. From responses to the letters certain ordinances are here reprinted to show the general character of municipal regulation of electric utilities in large and small cities. It is believed that these examples are typical of the ordinances now in force, and it is interesting to note that most cities having regulating ordinances are in States where electric service is also regulated by public service commissions.

SELECTED ORDINANCES REGULATING ELECTRIC SERVICE.

BIRMINGHAM, ALA.

ORDINANCE No. 150 creating the office of inspector of gas and meters, defining the duties and powers thereof; providing for the inspection of gas and electric meters, the collection of fees therefor.

Be it ordained by the City Council of Birmingham as follows:

SEC. 1. *Office of the inspector of gas and meters created.*—That there be and is hereby created the office of inspector of gas and meters in the city of Birmingham, to be elected as other city officials, to possess the same qualifications and to serve for the same term.

SEC. 2. *Bonds.*—Said inspector and each deputy hereafter appointed, shall, before entering upon their duties, execute a bond to the city in the sum of \$1,000, with such sureties as the mayor shall approve, conditioned for the faithful and true performance of the duties of that office.

SEC. 3. *Deputy inspector.*—The inspector of gas and meters may, by and with the consent and approval of the mayor, appoint such, and so many deputies as may be deemed necessary, said deputy shall have the power under the direction of the inspector of gas and meters to perform any duty which the inspector of gas and meters may be required to perform.

SEC. 4. *Duty to test meters.*—It shall be the duty of the inspector to examine and test any gas or electric meter furnished to any consumer of gas or electricity, by any gas or electric company furnishing gas or electricity in the city wherever requested so to do by any consumer. He shall also inspect all new electric meters, installed by said company, on the premises where the same are installed, and it shall be the duty of the company so installing said meters to immediately notify said inspector where the said meters are placed, and the said inspector shall immediately proceed to inspect the same, and all new gas meters shall be inspected and sealed before installation by the inspector. Such inspection, upon the request of a consumer, shall be made substantially in accordance with the following requirements:

Whenever any consumer of gas or electricity furnished by a gas or electric company furnishing gas or electricity in the city, shall make a request for such inspector to have any meter or meters furnished and installed by such gas or electric company on the premises of such consumer, inspected for the purpose of ascertaining whether such meter registers accurately, and pays to the city treasurer the fees hereinafter fixed, said inspector shall proceed to make the test of such gas or electric meter. For making such test the inspector shall give notice to the person making application for such test, and also to the gas or electric company whose meter is about to be tested, of the time and place where he intends to test such meter, notice to the company shall be given in writing, sent by mail to such gas or electric company at its principal office in this city, and notice shall be sent to such applicant in writing by mail, addressed to the premises described in the application for test. Such notice shall be mailed at least 24 hours before the time set for the test of such meter. The test of such gas meter shall be made by the inspector, or his duly authorized deputy or deputies, at such place as he may designate in such notices, and shall be made in such manner as to thoroughly test such meter, with the view of ascertaining whether it registers accurately.

SEC. 5. * * * All of said electric meters shall be tested and proved by said inspector in the manner best adopted to ascertain their correctness. If on being tested any electric meter shall be found to register quantities incorrectly to an extent exceeding 4 per cent, the same shall not be again used until the defect is remedied, the meter again inspected by the inspector, found to be correct and duly certified. Every electric meter shall be considered correct, and so certified, which shall register quantities not varying more than 4 per cent from the standard measure of electricity.

SEC. 8. *Fees.*—Any person, firm or company, or corporation desiring the inspection and testing of any gas or electric meter within the city, as provided for in this ordinance, shall accompany the application for such inspection with a fee of one (\$1) dollar for gas meters and fifty (50) cents for electric meters, which shall be paid to the city treasurer, and for which such applicant shall receive a receipt from the city treasurer showing such payment, which receipt shall describe the location of the meter to be inspected and shall contain the name of the person, firm or corporation for whose benefit said meter was installed. Such receipt, when presented to the inspector, shall be his authority for making the inspection herein provided for.

SEC. 9. *By whom fee is finally to be paid.*—If the result of any such inspection shall show any meter so inspected to be inaccurate and to have registered in such manner as to show a greater consumption of gas or electricity than was actually consumed, or than actually flowed through such meter, the amount advanced by the person desiring such test shall be forthwith returned by such treasurer to such person, and such inspection shall be made without cost or expense of any kind to him, and the gas or electric company shall adjust all differences with the consumer due to complained-of meters, in accordance with the inspection of the inspector. The period of adjustment not to extend over more than three months previous to the time of the test of the meters. The cost of making such inspection of any meter so found to be inaccurate shall be paid by the company furnishing gas or electricity through the same, and by whom and for whose benefit the same was installed, and the amount of the fee as herein fixed for such inspection shall be paid by such company upon a bill being presented to it by the inspector with his certificate showing that such meter was found by him to be inaccurate. If the result of any such inspection of any meter shows that such meter registered an equal or smaller amount of gas than was actually consumed, or actually flowed through such meter, in such case the expense of such inspection shall be paid for out of the fee required to be advanced by the person, firm, or corporation making application for such inspection, and no part of such fee shall in such case be returned to such applicant.

SEC. 10. *Office and office hours, apparatus, etc.*—Said inspector shall keep an office in the city hall, where he shall be found during the hours of the day, except when absent on business connected with his official duties. Said inspector shall keep a register or registers in his office, in which he shall record the number and description of each meter inspected, and the time when it was tested by him, together with a record of all notices sent or given by him and all other proceedings of his office. Such records shall at all times be open to public inspection.

SEC. 11. *Altering, etc., inspector's certificate, etc.*—It shall be unlawful for any person other than said inspector or his deputies to deface, alter, or remove any card, seal, or certificate placed on, or attached to any meter, or to place upon or attach to any meter any card, seal, or certificate, purporting to be the certificate of said inspector, under penalty thereafter specified.

SEC. 12. *Reports.*—Said inspector shall immediately after the first day of each month prepare and submit to the city council a report of the number of meters inspected during the previous month. Said inspector shall annually, on or before the first day of January each year, report in writing to the city council the transactions of his office during the preceding year, with such other information as he shall deem necessary and proper, and also from time to time such information as may be required by the mayor or city council.

SEC. 13. That all ordinances or parts thereof conflicting herewith be, and the same are hereby, repealed in so far as they conflict herewith. [Adopted May 6, 1903.]

CHARLESTON, S. C.

AN ORDINANCE To provide for the inspection of electric meters.

Be it ordained by the Mayor and Aldermen of Charleston in City Council assembled:

SEC. 1. That any consumer of electric light or power shall have the right to apply to the city electrician for an inspection and test of his meter, upon depositing with the city electrician a fee of twenty-five cents, and said electrician shall at once inspect said meter and test it.

In the event of its being more than 4 per cent fast the consumer shall have a right to rebate on his previous month's bill, at twice the price of the excess and the inspection fee. In the event of its being more than 4 per cent slow the company shall be entitled to the price of the extra current thereover consumed. [September 12, 1911.]

AN ORDINANCE To create the office of inspector of gas, water, and electric meters, and to prescribe the duties thereof.

Be it ordained by the Mayor and Aldermen of Charleston in City Council assembled:

SEC. 1. That on the second Tuesday in October, 1913, and on the same day in every year thereafter, there shall be nominated and appointed, subject to the confirmation of council, an inspector of gas, water, and electric meters, who shall serve for a term of one year from the date of his confirmation and until his successor shall be appointed and confirmed; provided, however, that such officer shall hold his office during said term at the will of the mayor and may be discharged or suspended for any cause. He shall receive an annual salary of fifteen hundred dollars (\$1,500) payable monthly.

SEC. 2. It shall be the duty of the meter inspector to make a practical test of every gas meter, water meter, and electric meter in the city of Charleston by passing through said meter, respectively, a certain volume of gas, water, and electricity, and observing if the meter indicates correctly the volume thus passed through it.

SEC. 3. He shall likewise close all fixtures and observe from the meter if there be a leak, in which event he shall promptly notify the consumer.

SEC. 4. He shall give preference of inspection to citizens applying to him for his services, in writing, and shall comply with such requests in the priority of receipt, making written reports to such applicants.

SEC. 5. He shall keep a daily record of the meters inspected and the results of his inspection, which records shall be accessible to any citizen desiring to inspect them.

SEC. 6. He shall make a weekly report to the mayor of the work accomplished and the results obtained.

SEC. 7. A gas meter shall be deemed accurate which upon test registers not more than 2 per cent fast nor more than 2 per cent slow, and an electric meter and water meter shall be deemed accurate that registers not more than 4 per cent fast or slow, but any percentage noted is to accordingly control the amount of the preceding month's bill and all future bills, computed on such meter.

SEC. 8. In the event that any person, firm, or corporation furnishing gas, water, or electricity shall knowingly or wilfully overcharge the city or any consumer for such light, water, or power furnished, such person, firm, or corporation shall be subject to a fine of not less than fifty dollars (\$50) for each offense.

SEC. 9. That in the event that said inspector shall find that the city or consumer has been undercharged, the city or consumer shall be liable to the payment of the correct charge.

SEC. 10. All ordinances and parts of ordinances inconsistent with this ordinance are hereby repealed. [October 28, 1913.]

CHICAGO, ILL.

[Meters used by private electric-light companies: Provision for testing and fixing fees therefor.]

Be it ordained by the city council of the city of Chicago:

SEC. 1. *The duty of the Commissioner of Public Service.*—Paragraph 1. It shall be the duty of the Commissioner of Public Service to provide for the test, inspection, sealing, and adjustment of all meters as hereinafter defined, used or to be used in the city of Chicago, in accordance with the provisions of this ordinance.

SEC. 2. *Authority of the Commissioner of Public Service.*—Paragraph 1. All installation tests and periodic tests as hereinafter defined shall be made by the Commissioner of Public Service or his authorized representative.

Paragraph 2. The Commissioner of Public Service or his authorized representative may inspect, test, adjust, or seal any consumer's meter at all reasonable hours.

SEC. 3. *Definition of seller and meter.*—Paragraph 1. The term "seller" when used in this ordinance shall mean and include any corporation, company, association, joint-stock company or association, firm, partnership, managing committee, or individual, their lessees, trustees, or receivers appointed by any court whatsoever (except however, such public utilities as may now or hereafter be owned or operated by the municipality), that now or hereafter may own, control, operate, or manage within the city of Chicago, directly or indirectly, any plant, equipment, or property, used for or in connection with the production, storage, transmission for sale, delivery or furnishing of electricity, within the city of Chicago; provided, however, that the provisions of this section shall not apply to any public utility company coming under the jurisdiction of and subject to regulation by the Public Utilities Commission having jurisdiction.

Paragraph 2. The term "meter" when used in this ordinance shall mean and include each and every electrical device that is now or that may hereafter be used for the purpose of measuring the quantity of electricity supplied to any consumer thereof.

SEC. 4. *Definition of tests.*—Paragraph 1. Whenever any meter shall be installed by any seller, as herein defined, to measure the quantity of electricity used by any consumer, it shall be tested and adjusted as hereinafter provided, within ninety (90) days after such installation. Whenever any meter is so tested, such test shall be termed within the meaning of this ordinance "Installation test."

Paragraph 2. All consumers' meters shall be tested as hereinafter provided. Such tests shall be termed within the meaning of this ordinance "Periodic test."

(a) Two and three wire commutating-type and mercury-type meters, up to and including 25 amperes rated capacity of meter element, shall be tested once in every eighteen (18) months.

(b) Two and three wire commutating-type and mercury-type meters, of over 25 amperes rated capacity of meter element, shall be tested once in twelve (12) months.

(c) Two and three wire single-phase induction-type meters, up to and including 25 amperes rated capacity of meter element, shall be tested at least once in every 24 months.

(d) Two and three wire, single-phase induction-type meters of over 25 amperes rated capacity of meter element shall be tested at least once in every eighteen (18) months.

(e) Self-contained polyphase meters and polyphase meters connected through current transformers or current and potential transformers to circuits up to and including 50 kilowatts rated capacity shall be tested once in every twelve (12) months.

(f) Self-contained polyphase meters and polyphase meters connected through current transformers or current and potential transformers to circuits of over 50 kilowatts rated capacity shall be tested once in every twelve (12) months.

(g) All maximum-demand meters shall be tested once in every five years.

SEC. 5. *Adjustment and test of meters.*—Paragraph 1. When any consumer's meter is tested by the Commissioner of Public Service or his authorized representative as hereinbefore prescribed and is found inaccurate it shall be adjusted by the Commissioner of Public Service or his authorized representative so as to register within one per cent (1%) any and all amounts of electricity passing through the said meter when such amounts are between ten per cent (10%) of and one hundred per cent (100%) of the rated capacity of the said meter. During the adjustment the voltage shall at all times be kept above ninety-five per cent (95%) of the rated voltage of the said meter.

Paragraph 2. Any meter which can not be adjusted so as to register accurately or any meter which creeps or registers when no electricity is passing through the same shall be removed from service within 30 days after notice thereof given by the Commissioner of Public Service to the seller.

SEC. 6. *Sealing of meters.*—Paragraph 1. Whenever any inspection, test, or adjustment of any consumer's meter shall be made, the Commissioner of Public Service or his authorized representative shall place a seal upon the said meter, that the said meter can not be changed, adjusted, or opened in any way without breaking the said seal. The said seal shall indicate the month of the year when the said seal was placed on the said meter.

Paragraph 2. It shall not be lawful for any seller or agent of such seller to use or permit the use of any electricity meter for the purpose of measuring the quantity of electricity supplied to any consumer, unless such meter shall have been tested, inspected, and sealed under the provisions of this ordinance within a period of 90 days after the meter has been put in service, and unless the seal placed thereon, as herein provided, shall be unbroken.

SEC. 7. *Fees.*—Paragraph 1. The Commissioner of Public Service shall demand and receive for the use of the city, before the delivery of the certificate provided for, in and by Sec. 13 of this ordinance, the following fees:

Single-phase and direct-current meters, two or three wire, 10 amperes or less..	\$1.00
Over 10 and not more than 25.....	1.25
Over 25 and not more than 50.....	1.50
For each additional 25 amperes.....	.25

Paragraph 2. For single-phase meters operating above 230 volts, and below 600 volts, and for direct-current meters operating above 230 volts, an additional charge of \$1 will be made.

Paragraph 3. Self-contained polyphase meters, up to and including 25 amperes rated capacity, \$3; self-contained polyphase meters, over 25 amperes and not more than 50 amperes rated capacity, \$3.50; for each additional 25 amperes, \$0.25.

Paragraph 4. Single-phase and polyphase meters connected through current transformers: The fee or fees charged for testing this type of meter will be the fee charged

in the table in paragraph 3 of this section, according to the rated capacity of the meter, plus a minimum charge of 75 cents per transformer up to 150 amperes rated capacity of said transformer, and thereafter a charge of 25 cents for each additional 50 amperes or fraction thereof.

Paragraph 5. For all direct-current meters operating on a shunt: The fee or fees charged for testing this type of meter will be the fee charged in the table in paragraph 1, of this section, according to the rated capacity of the meter, plus a minimum charge of 75 cents per shunt up to 150 amperes rated capacity of said shunt, and thereafter a charge of 25 cents for each additional 50 amperes or fraction thereof.

SEC. 8. *Standard meters.*—Paragraph 1. There shall be maintained at all times in the office of the Commissioner of Public Service standard instruments for the measurement of electromotive force and current, both alternating and direct, which instruments shall be accurate to within one-tenth ($\frac{1}{10}$ th) of one per cent (1%) when compared with the standards of the United States Bureau of Standards, and the Department of Public Service shall have these instruments sealed and certified by the United States Bureau of Standards at least once in every six (6) months. The said instruments so maintained and kept as primary standards for the purpose of checking the working standards used by said Commissioner of Public Service and his authorized representatives.

SEC. 9. *Records and reports.*—Paragraph 1. The Commissioner of Public Service shall keep a register or registers in his office in the city hall, in which he shall record the number and description of each consumer's meter inspected, tested, or adjusted by him or his authorized representative, and the time that such inspection, test, or adjustment is made, and the condition of the said consumer's meter when inspected, tested, or adjusted.

Paragraph 2. Such records shall be at all times open to the inspection of the mayor, the members of the city council, the head of any department, or any consumer, but in so far only as relates to the meter of such consumer.

Paragraph 3. The Commissioner of Public Service shall pay to the city collector each day, all fees, charges, moneys, or valuable consideration of any kind whatsoever collected or received by him, by reason of or for on account of the performance by him or his authorized representative, and each such payment shall be accompanied by a report in writing or directed to the city comptroller and verified by affidavit of the Commissioner of Public Service, or his authorized representative, which said report shall show in detail all fees, charges, moneys, or valuable consideration of any kind paid to, collected, or received by said Commissioner of Public Service or his authorized representative during the day preceding the day of such report, and such report shall be made daily and shall accompany each daily payment as hereinbefore provided for.

SEC. 10. *Police aid.*—Paragraph 1. Whenever it shall be necessary, in the opinion of the Commissioner of Public Service or his authorized representative, to call upon the department of police for aid or assistance in carrying out or enforcing any of the provisions of this ordinance, he shall have the authority to do so, and it shall be the duty of the said department of police or any member thereof when called upon by the said Commissioner of Public Service or his authorized representative to act in accordance with the instructions of and to perform such duties as may be required by him, by legal measures to enforce or put into effect the provisions of this ordinance.

SEC. 11. *Certificate required.*—Paragraph 1. Every person, except any public utility coming under the jurisdiction of and subject to regulation by the Utilities Commission having jurisdiction, corporation, company, association, joint-stock company or association, firm, partnership, managing committee, or individual, their lessees, trustees, or receivers, appointed by any court whatsoever, using now or hereafter any electrical device for measuring the electricity supplied to any consumer, except any public-utility company coming under the jurisdiction of and subject to

regulation by the Utilities Commission having jurisdiction, shall cause the same to be inspected, tested, and adjusted by the Commissioner of Public Service, or his authorized representative, and shall receive from the Commissioner of Public Service or his authorized representative upon payment of the required fees a certificate for each meter inspected, tested, or adjusted, in accordance with the provisions of this ordinance, and this certificate shall be a receipt for the money paid to the Commissioner of Public Service or his authorized representative, and a record of the test, inspection, or adjustment of said electric meter.

Paragraph 2. Any person, except any public-utility company coming under the jurisdiction of and subject to regulation by the Utilities Commission having jurisdiction, corporation, company, association, joint-stock company or association, firm, partnership, managing committee or individual, their lessees, trustees, or receivers, appointed by any court whatsoever, using any electrical device for measuring electricity supplied to any consumer, except any public-utility company coming under the jurisdiction of and subject to regulation by the Utilities Commission having jurisdiction, who has not obtained from the Commissioner of Public Service or his authorized representative the aforesaid certificate as required by this chapter in accordance with the provisions of this ordinance, shall be fined not less than twenty-five dollars (\$25) nor more than one hundred dollars (\$100).

SEC. 12. *Penalty for violation.*—Paragraph 1. Any person, except any public-utility company coming under the jurisdiction of and subject to regulation by the Utilities Commission having jurisdiction, firm, corporation, seller or consumer, who shall wilfully remove or destroy or in any manner cause to be removed or destroyed any stamp or seal of inspection from any meter in service shall be fined not less than twenty-five dollars (\$25) or more than one hundred dollars (\$100).

Paragraph 2. Any person, except any public-utility company coming under the jurisdiction of and subject to regulation by the Utilities Commission having jurisdiction, firm, corporation, seller or consumer, violating or refusing to comply with the provisions of this ordinance shall be fined not less than five dollars (\$5) or more than twenty-five dollars (\$25) for each such offense. A separate and distinct offense shall be held to have been committed each day any person, except any public-utility company coming under the jurisdiction of and subject to regulation by the Utilities Commission having jurisdiction, corporation, firm, seller or consumer, violates or fails to comply with the provisions of this ordinance.

Paragraph 3. It shall be the duty of the said Commissioner of Public Service to report forthwith to the prosecuting attorney of the city the names and places of business of all persons violating any of the provisions of this ordinance, and of all persons making use of any fraudulent or unsealed meters.

SEC. 15. *Ordinance effective.*—Paragraph 1. This ordinance shall take effect and be in force from and after its passage and publication.

Be it ordained by the City Council of the city of Chicago (July 15, 1915):

SEC. 1. *The duty of Commissioner of Public Service.*—It shall be the duty of the Commissioner of Public Service to provide for the test, inspection, sealing, and adjustment, in accordance with the provisions of this ordinance, of all meters as hereinafter defined, used or to be used in the city of Chicago.

SEC. 2. *Authority of Commissioner of Public Service.*—Working standard tests, complaint tests, and proof tests, as hereinafter defined, shall be made by the Commissioner of Public Service, or his representative, in the manner hereinafter provided.

SEC. 3. *Definition of seller, meter, and consumer.*—Paragraph 1. The term "seller" when used in this ordinance shall mean and include any corporation, company, association, joint stock company or association, firm, partnership, managing committee or individual, their lessees, trustees, or receivers appointed by any court whatsoever (except, however, such public utilities as may now or hereafter be owned or operated by any municipality), that now or hereafter may own, control, operate, or manage within the city of Chicago, directly or indirectly, any plant, equipment, or property

used in connection with the production, storage, transmission, sale, delivery, or furnishing of electrical energy within the city of Chicago, may offer such utility for sale to the public, and may use the public streets or alleys of said city for the purpose of conveying its said utility to its customers.

Paragraph 2. The term "meter" when used in this ordinance shall mean and include each and every electrical device that is used in the city of Chicago for the purpose of measuring the electricity supplied any consumer thereof.

SEC. 4. *Definition of tests.*—Paragraph 1. Whenever any meter shall be installed for the purpose of measuring electricity to be used by any consumer, it shall be tested and adjusted, as hereinafter provided, within 90 days from the time of its installation. The test so to be made within 90 days is referred to in this ordinance as the "Installation test."

Paragraph 2. Whenever any person shall make application to the Commissioner of Public Service for a test of any consumer's meter, and shall present the receipt hereinafter prescribed, such test as hereinafter prescribed shall be made by the Commissioner of Public Service or his representative, and is referred to in this ordinance as the "Complaint test."

Paragraph 3. The Commissioner of Public Service shall make tests of meters upon the premises of consumers, for the purpose of checking up and testing the accuracy of the tests made by the meter testers of the seller of such a number of consumers' meters as the Commissioner of Public Service shall deem sufficient for that purpose. The test so to be made is referred to in this ordinance as the "Proof test."

SEC. 5. *Testing meters of sellers.*—Paragraph 1. Meters installed by sellers in the premises of consumers shall be tested by competent meter testers, employed by the seller, in the manner provided in this ordinance, but by means only of working standards or standard test meters, which shall be inspected, tested, and sealed by the Commissioner of Public Service of the city of Chicago, or his duly authorized representative, once in every 10 days. When such inspection and test shall have been made, the Commissioner of Public Service, or his duly authorized representative, shall place upon the working standard or standard test meter so inspected and tested, a seal which shall indicate that such meter has been inspected and tested by the city of Chicago, and such seal shall set out the date of such test.

It shall not be lawful for any such seller, or any officer or agent of such seller, to use, or permit the use of, any such working standard or standard test meter in and about the inspection or testing of any meter used in measuring the electricity sold by such seller to any consumer, unless such working standard or standard test meter shall have been tested, inspected, and sealed under the provisions of this ordinance, within a period of 10 days preceding the date of its use for such purpose by or for such seller, and unless the seal placed thereon as herein provided shall at the time be unbroken.

Paragraph 2. It shall be the duty of any person making the test provided for in this section to permit the consumer whose meter is about to be tested, or his representative, to examine the seal affixed by the Commissioner of Public Service thereon.

Paragraph 3. The tests required to be made by the Commissioner of Public Service as provided for in this section shall be made at the expense of the seller, and the fee to be charged for each test and sealing of each such working standard or standard test meter shall not be more than 40 cents for each such working standard or standard test meter so tested.

Paragraph 4. It shall be the duty of every seller to file with the Department of Public Service on or before tenth day of each calendar month, a report of all the meters tested in behalf of such seller on consumer's premises, showing the results of such tests in accordance with rules and in the manner to be prescribed by the Department of Public Service, and in addition thereto such seller shall keep on file for inspection by the Department of Public Service a complete record of every test made by it on consumer's meters for a period of two years after the date of such tests.

SEC. 6. *Removing seal—penalty.*—Paragraph 1. It shall be the duty of the Commissioner of Public Service to cause all working standards or standard test meters of sellers to be properly sealed in accordance with the provisions of this ordinance, and no such working standard or standard test meter shall be used by any seller, or any officer, agent, or employee of such seller, unless the seal placed thereon by the Commissioner of Public Service shall be intact.

Paragraph 2. It shall be the duty of the Commissioner of Public Service to report forthwith to the prosecuting attorney of the city the names and addresses of all sellers and persons violating any of the provisions of this ordinance; and of sellers and persons making use of any fraudulent meters, and of all sellers or consumers, or of their agents or employees, using any working standards or standard test meters unsealed in violation of the provisions of this ordinance.

SEC. 7. *Proof tests.*—Paragraph 1. It shall be the duty of the Commissioner of Public Service to make or cause to be made proof tests of meters in his discretion at such time and in such manner as he shall regard most likely to effectually check the testing done by or on behalf of such seller, and to detect any fraudulent or unlawful practices of such seller or its agents or employees; provided, that such tests shall only be made after the Commissioner of Public Service shall have given to the seller 48 hours previous notice in writing, by mail or by personal service, that he is about to make such tests and desires the attendance of a representative of the seller at his office in the city hall for that purpose at a given time, and in the presence of such representative of such seller, if he shall attend for that purpose, pursuant to the notice; provided, further, however, that such notice shall not designate the location or contain a description of the meters the commissioner intends to test.

SEC. 8. *Complaint tests.*—It shall be the duty of the Commissioner of Public Service, upon request of any consumer, to examine and test any meter furnished to such consumer by the seller, and used for the purpose of measuring electricity supplied to such consumer by such seller. Such inspection shall be made substantially in accordance with the following requirements:

(a) Any consumer desiring the inspection of any electric meter within the city, as provided for in this ordinance, shall accompany the application for such inspection with a fee as hereinafter prescribed, which shall be paid to the city collector showing such payment, which receipt shall describe the location of the electric meter to be inspected and its rated capacity, and shall contain the name of the person, firm, or corporation for whose benefit said electric meter was installed. Said receipt when presented to said Commissioner of Public Service shall be his authority for making the inspection herein provided for.

(b) Before making such inspection or test the Commissioner of Public Service shall give notice in writing to the consumer making application therefor, and also to the seller whose meter is about to be inspected, setting forth in such notice the time when and place where such inspection or test of such meter is to be made. Such notices shall be mailed at least 48 hours before the time set for the inspection of such meter. The notice sent to the consumer shall be addressed to the premises described in the application for inspection and wherein the meter to be inspected is installed. The notice to the seller whose meter is to be inspected shall be addressed to the principal office of such seller in the city of Chicago. The inspection of any such meter shall be made by the Commissioner of Public Service, or his duly authorized agent, at the place where the meter is installed and in place, and such inspection shall be made in such a manner as to thoroughly test such meter, for the purpose of ascertaining whether it registers correctly under the applicant's usual conditions of use of electricity furnished by the seller whose meter is to be inspected.

SEC. 9. *Standard meters.*—There shall be maintained and kept at all times, in the office of the Commissioner of Public Service, primary standard instruments for the measurement of electro-motive force and current for both alternating current and

direct current, which instruments shall be accurate to within one-tenth of 1 per cent when compared with the standards of the United States Bureau of Standards and it shall be the duty of said Commissioner of Public Service to have all such instruments tested, sealed, and certified by the United States Bureau of Standards, at least once every six months. The primary instruments so maintained and kept shall be used as standards for the purpose of checking the working standards used by said Commissioner of Public Service.

SEC. 10. *How tests shall be made.*—Paragraph 1. Any electric meter inspected or tested by said Commissioner of Public Service, or by a seller, under and in accordance with the provisions of this ordinance, shall be deemed accurate if it registers not to exceed 4 per cent above or below the reading of the working standard. Every meter tested or inspected under or in accordance with the provisions of this ordinance shall be tested for the purpose of ascertaining its accuracy on "light load," and "full load" of said meter.

Paragraph 2. The term "light load" shall mean a load equivalent to 10 per cent of the rated capacity of the meter. The term "full load" shall mean a load equivalent to any load between 80 per cent and 100 per cent of the rated capacity of the meter.

Paragraph 3. Whenever a meter inspected or tested under and in accordance with the provisions of this ordinance by the Commissioner of Public Service shall be found to be inaccurate, as in this ordinance defined, such meter shall be accurately adjusted by the seller, so as to make it accurate within the limits herein defined, and if, in the opinion of the Commissioner of Public Service, said meter can not be made accurate within the limits as so defined, then the Commissioner of Public Service shall have the power to order the installation of another meter in lieu of the one found to be inaccurate, and it shall thereupon be the duty of the seller to install another meter in compliance with such meter.

Paragraph 4. Whenever a meter inspected or tested under and pursuant to the provisions of this ordinance, by or on behalf of a seller, shall be found inaccurate, as defined in this ordinance, the seller shall either immediately accurately adjust such a meter or replace the same by another meter within 10 days.

Paragraph 5. Creeping meter: No meter which registers on no load where the applied voltage is less than 110 per cent of standard service voltage shall be placed in service or allowed to remain in service.

SEC. 11. *Incorrect meter—rebates—deficiency charge.*—Paragraph 1. Whenever any meter shall be inspected or tested under the provisions of section 8 of this ordinance, a test reading of such meter shall be made at its usual average load, if such load can be determined, and, if such load can not be determined, then it shall be tested at its "normal load" as hereinafter fixed. If any such meter shall register to exceed 4 per cent above or below the working standard at the usual or "normal load" it shall be deemed incorrect for the purpose of this section.

Paragraph 2. The following classification, in percentage of rated capacity, shall be used in determining the "normal load," above specified, of various meters:

- (a) Residence and apartment lighting, 25 per cent.
- (b) Elevator service, 40 per cent.
- (c) Factories (individual drive), churches, and offices, 45 per cent.
- (d) Factories (shaft drive), theaters, clubs, entrances, hallways, and general store lighting, 60 per cent.
- (e) Saloons, restaurants, pumps, air compressors, ice machines, and moving-picture theaters, 70 per cent.
- (f) Sign and window lighting and blowers, 100 per cent.

Paragraph 3. When a meter is found to be connected to an installation consisting of two or more of the above classes of loads, the "normal load" must be obtained by taking the average of the percentage for the classes so connected. If the result of

such test at such usual or "normal load" shall show any meter to be incorrect, as above defined, it shall be presumed that such meter was in the same condition and incorrect to the same degree for a period of not to exceed 90 days prior to the date of such inspection or test.

Paragraph 4. Nothing herein contained, however, shall be held to preclude either the consumer or the seller from establishing by competent evidence the fact that such meter was or was not incorrect for a longer or shorter period of time than 90 days prior to the date of such last inspection.

Paragraph 5. Where the result of any inspection by the Commissioner of Public Service, made under and in accordance with this ordinance, shows that the meter so inspected is incorrect, as herein defined, and such incorrectness shall operate to the disadvantage of the consumer by causing to be registered a greater amount of electricity than actually flowed or passed through such meter, in such case such consumer shall be entitled to a rebate from the seller, based upon the assumption that such incorrect registration existed for a period of 90 days prior to the date of said inspection or test; provided, however, that if the consumer shall be able to establish the fact that such condition existed for a longer period than said 90 days, or if the seller shall be able to establish the fact that such condition did not exist for so long a period as said 90 days, then, and in either event, the consumer shall be entitled to a rebate for such period of time as it shall be shown such meter registered a greater amount of electricity than actually passed through the same.

Paragraph 6. If the result of any inspection, made by the Commissioner of Public Service under and in accordance with this ordinance, of any meter shall show that such meter is incorrect, and that such incorrectness operated to the disadvantage of the seller by reason of such meter registering a smaller amount of electricity than actually passed through same, in such case such condition shall be presumed to have existed for a period of not to exceed 90 days prior to the date of such inspection, and such seller shall be entitled to charge the consumer an amount equal to what would have been charged had the meter registered correctly, said amount to be based upon the assumption that said meter registered incorrectly in the same degree for a period of not to exceed 90 days prior to the date of such inspection; provided, however, that if the seller shall be able to establish the fact that such condition existed for a longer period than said 90 days, or if the consumer shall be able to establish the fact that such condition did not exist for so long a period as said 90 days, then, and in either event, the seller shall be entitled to charge said consumer for such deficiency during the time that said deficiency shall be shown to have existed.

SEC. 12. *By whom inspection fee paid.*—If the result of any complaint test, made under and in accordance with the provisions of this ordinance, shall show any meter so inspected to be inaccurate or incorrect, as defined herein, on any test hereinbefore provided, and to be registering a greater amount of electricity than passes through the same, within the limits fixed therein, the amount advanced by the consumer requesting such inspection shall be forthwith returned to him, and such inspection or test shall be made without cost or expense of any kind whatsoever to such consumer; and in such case the fee provided for such inspection or test shall be charged to and paid by the seller installing or using the meter so found to be inaccurate or incorrect. If the result of such inspection or test shall show such meter not to be registering a greater amount of electricity than passes through the same, within the limits fixed herein, the expense and cost of such inspection or test shall be paid out of the fee required to be advanced by the consumer making the application for such inspection, and no part of the fee so advanced shall in such case be returned to such applicant. The current consumed or used in making such inspection or test shall not be charged to the account of such consumer.

SEC. 13. *Binding character of tests.*—The inspection and test herein provided for, to be made by the Commissioner of Public Service, shall be conclusive upon both the consumer making application for such inspection or test and the seller installing or using such meter.

SEC. 14. *Schedule of fees for complaint test.*—The following shall be the fees charged by the Commissioner of Public Service, upon a complaint test, for the inspection or testing of electric meters operating on circuits of 500 volts or less, to wit:

AMPERES, RATED CAPACITY.

	Fees.
Ten, or less.	\$0. 50
Over 10, but not more than 25.	1. 00
Over 25, but not more than 50.	3. 00
And for each additional 25 amperes, or fraction thereof.	. 50
For each 1,000 volts or fraction thereof, over and above 500 volts.	1. 00

SEC. 15. *Records to be kept.*—Said Commissioner of Public Service shall keep a register or registers in his office in the city hall in which he shall record the number and description of each meter inspected by him and the time of such inspection and the condition of meter when inspected and all reports filed with him, together with all notices sent or given by him and all other proceedings of his office in reference thereto. Such records shall at all times be open to the inspection of the mayor, any member of the city council, the head of any department, or any citizen of the city of Chicago. Such records shall be kept for a period of two years after the date of such tests.

SEC. 16. *Copies of reports.*—Any consumer shall at any time be entitled to receive from the Commissioner of Public Service a copy of any report or record, whether made by the Commissioner of Public Service or his representative, or by or on behalf of any seller, and on file in the office of the Commissioner of Public Service, in so far only as relates to the meter of such consumer, upon the payment of a fee of 25 cents to the Commissioner of Public Service.

SEC. 17. *Monthly report.*—Said Commissioner of Public Service shall immediately after the first of each month prepare and submit to the comptroller a report of the number of electric meters inspected during the previous month, and of any fees collected by him under the provisions of this ordinance.

SEC. 18. *Penalties.*—Any seller or consumer or any officer, agent, or employee of either such seller or consumer, who shall violate or refuse to comply with any of the provisions of this ordinance, shall be fined (except as herein otherwise provided) not more than \$200 for each offense. A separate and distinct offense shall be held to have been committed each day any seller or consumer violates or fails to comply with the provisions of this ordinance.

SEC. 19. *Repealing clause.*—Sections 838, 839, 840, 841, 842, 843, 844, and 845 of the Chicago Code of 1911 are hereby repealed.

SEC. 20. This ordinance shall take effect and be in force from and after its passage and publication.

AN ORDINANCE For the purpose of fixing * * * the maximum rates for supplying electricity * * * and for other purposes * * *. [Passed Nov. 26, 1913.]

SEC. 1 [last paragraph]. The voltage on any of said Commonwealth Edison Company's distributing lines from which electricity for lighting purposes is furnished, shall as measured at the consumer's service, not vary more than five per cent (5%) either above or below the normal voltage carried by the circuit upon which the service is rendered; provided, however, that variations due to accidents or load conditions over which said company has no immediate control, shall not be considered a violation of this provision until said company shall have had notice in writing from a consumer affected and thirty (30) days time in which to correct such conditions.

CINCINNATI, OHIO.

The superintendent of street lighting department writes as follows:

1. The allowable error of electric meters is 5 per cent.
2. There is no regulation of variations in voltage.
3. No survey of voltage is made by any municipal engineer.
4. Meters are tested by this department upon complaint of the consumer, who makes a deposit of from \$1.50 to \$5, depending upon the size. If in the event that the meter runs faster than 5 per cent fast, the consumer's deposit is returned and the company makes a rebate proportionate to the amount in excess of 5 per cent. If in the event that the meter registers less than 5 per cent fast, the money is turned into the city treasury.
5. The company makes tests periodically, if in their judgment a meter is not proving accurate, and only on their own initiative.
6. There is provision in the city street-lighting contract which provides that graphic recording ammeters be connected to each lighting circuit, same to be under the direct supervision of this department. These have not been installed to date. [Letters of April 7, 1914, and March 16, 1922.]

DALLAS, TEX.

AN ORDINANCE Regulating electric light and gas meters, providing for the inspection thereof, prescribing the quality of gas to be furnished to the inhabitants of the city of Dallas, the rate to be charged for gas and electricity, and creating the office of a gas meter inspector, defining the duties thereof, and providing for the inspection of electric meters, and providing a penalty.

SEC. 13. That for the purpose of inspecting electric meters, the duty is hereby conferred upon the city electrician or his assistant to inspect the same and whenever any user or consumer of electricity is of the opinion that the meter used to measure or record the same is incorrect, for any reason, said person may make application to the city electrician and accompany said application with a deposit of 50 cents, which deposit he shall place in the hands of the assessor and collector of taxes and receive a receipt from said officer for same, which receipt he shall exhibit to the city electrician or his assistant; or he may deposit with the said assessor and collector of taxes said sum of 50 cents, requesting that his meter be examined, and leaving with the said assessor and collector of taxes his name and the address of the place where said meter is located. He shall receive from the assessor and collector of taxes a receipt for said deposit of 50 cents and it shall be the duty of the assessor and collector of taxes, as soon as practicable, to deliver to said electrician the name of all persons making such deposits and requesting an inspection of their meters, whereupon it shall be the duty of the city electrician or his assistant to have said meter examined as soon as practicable, not later than 24 hours from the receipt of said application to test and examine said meter.

That if upon examination it is determined by said city electrician or his assistant that said meter is inaccurate, he shall report such fact to the owner of said meter and it shall be the duty of said owner of said meter to correct the same, under the direction of the city electrician or his assistant, and if necessary, remove the same and place in lieu thereof a meter tested and approved by said city electrician.

That said meter shall be removed within 24 hours after the same has been ordered removed by said city electrician or his assistant and notice has been received by the owner of the same.

And if said meter examined and tested registered more than 2 per cent in excess of the actual amount passing through it, the electric company or companies shall be liable to pay to the city of Dallas the sum of \$1, which shall be paid upon the demand of the said city electrician or his assistant to the assessor and collector of taxes.

That in case the said city electrician, or his assistant, upon the examination of said meter, determines that the meter is correct or slow to the extent of more than 2 per cent the 50-cent deposit made by the applicant or consumer shall be retained by the assessor and collector of taxes of the city and the city electrician shall report such fact to the consumer as well as to the assessor and collector of taxes.

That in the event any meter is found to be incorrect the city electrician or his assistant shall notify the applicant, requesting him in said notice to produce the receipt received from the assessor and collector of taxes for his deposit and upon presentation of the said notice and the receipt obtained from the assessor and collector of taxes, the assessor and collector of taxes shall return the 50 cents so deposited and the electric company owning said meter shall be required to pay the \$1 hereinabove mentioned, which shall be payable upon demand of the said city electrician or his assistant to the assessor and collector of taxes.

SEC. 14. That whenever, in the opinion of any person, firm, or corporation manufacturing or supplying electricity to the public under the terms of their ordinance, any meter used by them for the purpose of measuring electricity is incorrect for any reason, said person, firm, or corporation shall be entitled to have any such meter inspected by the city electrician or his assistant by making the deposit and complying with the terms of the above and foregoing section, and in all such cases the electric company or companies making said application shall be subject to the penalty provided in section 13 as in other cases.

SEC. 15. That the Board of Commissioners may from time to time pass additional rules and regulations for the inspection of electric meters and may authorize electric companies to adopt such rules as it deems reasonable for furnishing electricity to the public, but all rules or any rule so adopted and promulgated by any such company may be changed, revised, or abrogated by the Board of Commissioners of the city of Dallas.

SEC. 16. That the owner, or their agent, of any gas or electric meter may be present during the time any inspection, examination or test is being made of any of their respective meters, and it shall be the duty of the gas meter inspector and the city electrician or his assistant to notify the owner of the gas or electric meter he proposes to examine or test of the time when such examination shall be made.

SEC. 17. That should the city electrician or his assistant determine that in order to inspect any electric meter complained of, it will be necessary to have the same removed, it shall be the duty of the electric company owning said meter to remove the same in accordance with the direction of said city electrician or his assistant within a reasonable time after receipt of notice from said city electrician so to do, which time shall not exceed 24 hours from receipt of said notice.

SEC. 18. That whenever an electric meter used for the purpose of measuring the amount of electricity furnished to consumers, upon examination is found to have recorded or registered more electricity above the variation in this ordinance prescribed than was actually used by any consumer, then a deduction shall be made from the bill proportioned according to the prices charged to such consumer.

SEC. 19. It shall be the duty of said city electrician or his assistant to examine and test any electric meter complained of which is properly filed in accordance with this ordinance. No electric meter shall be approved as correct which registers at an amount more than 2 per cent greater or less than the amount actually passing through it. Said city electrician shall keep suitable books in his office in the city hall, which shall be furnished by the city, in which said books he shall record the number of meters tested, marked, or sealed by him, the date of said tests, and the person having it so tested, marked, or sealed, and full proceedings in his office, and said city electrician shall make daily reports of his inspections to the Commissioner of Streets and Public Property, and a monthly report thereof to the Board of Commissioners.

SEC. 20. That the Board of Commissioners shall furnish suitable apparatus for the inspector to test the accuracy of electric meters.

SEC. 21. That said gas meter inspector and city electrician or his assistant shall at all times be civil and courteous to the public and especially willing and ready to lend every assistance to persons using gas meters or electric meters, in order that they may learn how to read said meters, or operate the gas fixtures or electric connections so as to economize in the use of said gas and electricity.

Passed February 17, 1908.

HARRISBURG, PA.

[File of Common Council No. 31: Session of 1912-13.]

AN ORDINANCE To amend section eleven of an ordinance entitled "An Ordinance giving permission to The Paxtang Electric Company of Harrisburg, etc."

(d) That such person, firm or corporation as may acquire the Paxtang Electric Company in manner aforesaid, will agree to so arrange its transmission and distribution system and so operate the generating equipment, that, on and after eighteen (18) months after such person, firm or corporation shall have acquired the Paxtang Electric Company, the voltage of any standard distributing line over which electricity for lighting purposes is furnished within the city of Harrisburg, shall as measured at the terminals of the company's service lines, not vary more than five (5) per cent, either above or below the normal voltage carried by the current upon which the service is rendered.

In order to keep records of the voltage variation in different parts of the city, the said person, firm or corporation will provide, install, and connect at its own expense at such points as the city electrician may direct, five (5) recording volt meters of some standard manufacture, enclosed in lock boxes or closets, the keys whereof shall be delivered to and remain in the hands of the said electrician. It shall be the duty of said city electrician to change the record paper at proper intervals and maintain the ink supply, at the cost of the city.

The records of such volt meters shall be kept in the office of the city electrician for at least ninety (90) days and shall at all reasonable times be subject to inspection by such person, firm or corporation aforesaid, or its duly authorized agents, who shall also have the right to make photographic or other copies thereof, and such person, firm or corporation, or its duly authorized agent, shall likewise be given access for inspection purposes to said volt meters in the presence of the city electrician or a representative by him authorized.

Such person, firm or corporation so acquiring the Paxtang Electric Company, as aforesaid, shall pay to the city of Harrisburg for each breach of the provisions of this paragraph of this ordinance, not corrected with due diligence after receipt of written notice from the city electrician that the voltage has varied beyond the limits herein specified for three (3) consecutive days, at any point within the city of Harrisburg and that such excess variation has continued for periods of more than ten (10) consecutive minutes on each of said days, the sum of one hundred dollars (\$100) for each such default extending over the period of three (3) consecutive days.

Provided, however, That no claims or suit to recover the penalty herein provided shall be enforceable unless such claim be made or suit be brought within ninety (90) days of the time when such breach is alleged to have occurred.

The voltage variation herein and hereby prohibited shall not be construed to include temporary variations resulting from incidental, unusual, or abnormal load conditions over which such person, firm or corporation may have no immediate control, nor to voltage variations which may exist at the time of accidents to machinery, devices, or transmission lines, and such person, firm or corporation may by publication of notice of any such accident in any local newspaper of the happening thereof, relieve itself

from the operation of the above-prescribed penalty, but this shall not relieve such person, firm or corporation from the exercise of due diligence in making needed repairs or additions to overcome the effects of any such accident or accidents or such load conditions.

Approved May 29, 1912.

KANSAS CITY, MO.

AN ORDINANCE Creating the office of inspector of electric meters, providing for an assistant inspector, and fixing the salaries thereof, providing for the establishment of a city laboratory and for the purchase of instruments therefor, prescribing the duties of said office and the methods and manner of testing electrical instruments, fixing a license tax upon electric meters, and repealing other ordinances.

Be it ordained by the Common Council of Kansas City:

SEC. 1. For the purpose of enforcing the ordinances of this city relating to the manufacture, distribution, and measurement of electrical current, and for the purpose of providing a method by which electric meters may be fairly and accurately tested, there is hereby created the office of inspector of electric meters.

SEC. 2. The said inspector shall be appointed by the Mayor, and shall hold his office subject to Article XV of the charter of Kansas City, Mo., relating to civil service, and shall be paid a salary of eighteen hundred dollars (\$1,800) per year, and said inspector, subject to the terms of said article relating to civil service, shall appoint an assistant inspector at a salary of twelve hundred dollars (\$1,200) per year; both such salaries shall be paid as the salaries of other officers of the city are paid.

The said inspector shall be an expert in theory and practice in the use of electrical measuring instruments, apparatus, and appliances, and in the installation of electric wires and matters pertaining thereto; and he shall have had prior to his appointment five (5) years' practical experience in such work; he shall give bond in the penal sum of five thousand dollars (\$5,000) with two or more sufficient sureties to be approved by the city comptroller, conditioned upon the skillful, faithful, and impartial performance of the duties of his office.

The assistant inspector shall have the same qualifications as the inspector except only that it shall not be required that said assistant shall have had five (5) years' practical experience in said work.

SEC. 3. The city purchasing agent shall, upon requisition from said inspector, subject to the provisions of the charter, purchase and deliver to said inspector at a cost of not to exceed twenty-five hundred dollar (\$2,500) electrical measuring instruments to consist of the most accurate and standard fixed and portable instruments ordinarily used for the purpose of testing the accuracy of electric meters.

The city comptroller shall furnish said inspector proper space in the city hall for such laboratory and said inspector shall install therein said instruments. Said inspector shall have sole custody and control over said instruments, and shall place such safeguard thereabouts as to insure that the accuracy thereof will not be interfered with in any manner whatsoever; shall from time to time take all steps necessary or expedient to insure that said instruments are remaining standard and shall from time to time make proper tests to insure their accuracy and for that purpose may have the same tested at the laboratory of the State University in this and other states having equipment for that purpose, but shall not expend for last-named purpose more than the sum of two hundred dollars (\$200) per year without special ordinances of the city.

SEC. 4. Said inspector and assistant inspector shall perform their duties under the supervision of the Public Utilities Commission, which commission shall make public rules and regulations not inconsistent with the terms of this ordinance subject to which said duties shall be performed. Said inspector shall have his office with the clerk of the Utilities Commission; said clerk shall receive complaints of the public and requests for the inspection of meters, refer them to said inspector, and shall see

that complete and accurate records are kept of complaints, inspections, the results thereof, and other matters properly pertaining thereto.

SEC. 5. It shall be the duty of every person, firm or corporation setting meters, to list same within ten (10) days after installation and notify the electrical meter inspector of all such installation and furnish him with a copy of such test within forty-eight (48) hours after such installation, and the electrical meter inspector, whenever he deems it necessary, in any case, inspect any meter without waiting for a complaint from any one.

SEC. 6. If any consumer of electricity furnished by any seller thereof to the public shall make application to the clerk of the Public Utilities Commission, or to said inspector, for a test of the meter through which the same is furnished, and shall accompany such application with a fee of seventy-five (75) cents, such inspector, together with such assistant, shall proceed as soon as may be, to make a test of the accuracy of said meter, make and sign original notes of such test and file and preserve the same in his office. Said inspector shall also forthwith, in writing, inform both the consumer and the furnisher of electricity, of the result of said test.

SEC. 7. Any meter not in excess of two and one-half per cent fast, or two and one-half per cent slow, on an average load, shall be deemed commercially correct. If the meter is found upon completion of the test, to be more than two and one-half fast or two and one-half per cent slow, the said inspector shall then and there recalibrate and leave the same operating accurately and approved by said inspector, or if the meter be broken, or if for any other reason it is not practicable to recalibrate the same, then the inspector shall order said meter removed and a new meter put in its place. The owner of the meter furnishing the current, shall have the right to have a representative present at each and every test and recalibration; such representative shall be permitted to be present throughout the same and to take notes thereof.

SEC. 8. If the meter shall be found to be over two and one-half per cent fast, the seller of the current shall, within fifteen (15) days after notification of such fact by said inspector, refund to the consumer an amount equal to the percentage the same is found to be fast on the bills the consumer has paid for current, from the day said meter was recalibrated or removed back to two preceding months regular readings, such period not to exceed ninety (90) days, or less than sixty (60) days, and in the event the meter has not been installed for over ninety days, the period for adjustment shall date from the day said meter was set. Such refund shall be paid to the consumer at the address given by the consumer on his contract. If the same is not paid to the consumer within thirty (30) days after such notice by the inspector, the seller shall then be liable to the consumer for twice the amount of such refund, and the consumer shall have the right to withhold further payments from the company until this double amount is made good. If, however, the consumer is indebted to the seller of current, at the time such refund is due the consumer, the seller may deduct from the refund, such amount and credit the consumer therewith.

SEC. 9. If the meter tested shall be found to be over two and one-half per cent slow the consumer of the current shall within fifteen (15) days after notification of such fact by said inspector, pay to the seller an amount equal to the percentage the same is found to be slow on the bills the consumer has paid for current, from the day such meter was recalibrated or removed, back to two preceding months regular readings, such period not to exceed ninety days, or be less than 60 days, and in the event of the meter has not been installed for over ninety days, the period for adjustment shall date from date said meter was set. If said amount is not paid by the consumer within thirty (30) days after the test the company is authorized to remove the meter and disconnect service from said consumer, and shall not be required to reconnect service until all old accounts are settled, and under such circumstances shall be permitted to make a charge of \$5 before resetting another meter for said consumer to reimburse said company for the cost of removing the first meter, and resetting the second.

SEC. 10. In case of a stopped meter, and the inspector being so notified either by consumer or company, the inspector shall order that a new meter be installed and the average current consumed per day, in the ten days succeeding the installation of said meter as shown by this new meter, shall be taken as a basis of settlement for the time it is known the meter has been stopped, or if the time is not known, such time, not to exceed thirty (30) days, as in the judgment of the inspector is in fairness to both parties.

SEC. 11. In case it is found at any time the company that a meter on the premises of a consumer has been tampered with, or purposely made inaccurate, or that the meter seal has been tampered with or broken, or wires attached to the meter in order to make inaccurate readings or any wires so run as to divert current so that it does not pass through the meter, the inspector and city electrician shall be so notified and upon their finding any of the above conditions, shall then authorize the company to remove said meter and all service from said consumer, and the seller of current may, thereafter, refuse to furnish service to the person served through this meter at the place where the meter was installed or any other place.

SEC. 12. Every person, firm, association, or corporation furnishing electrical current to the public for hire, and employing electrical meters for measurement of the same, shall pay to the city for the privilege of using such meters a license fee of twenty cents per year for each and every meter so used, which sum shall be paid in advance on the first day of November of each year; and the number of meters upon which said license shall be paid, shall be those in use on the first day of November of each year; and those subject to said license shall, on the first day of November of each year, furnish to the city a sworn statement of the number of meters in use at that date.

SEC. 13. Any person practicing or attempting to practice any frauds upon any seller of electricity, subject to the terms of this ordinance, by tapping or connecting to the feed wires of such seller and obtaining current without a meter, and any person, firm or association or corporation who will wilfully refuse to comply with any of the provisions of this ordinance or the spirit thereof, and any person, firm, association, or corporation furnishing electricity to the public for hire who or which shall permit any electricity meters by which said current is measured, to become or remain more than two and one-half per cent fast, or violate any other provision of this ordinance, shall be deemed guilty of a misdemeanor, and of a violation of this ordinance, and upon conviction thereof, shall be punished by a fine of not less than five dollars (\$5) or more than one hundred (\$100) dollars for each violation of this ordinance.

SEC. 14. In addition to the above duties, said inspector shall from time to time test the accuracy of the standard testing instruments of every person, firm, association or corporation, engaged in selling electrical current to the public for hire, and for that purpose shall have access at all reasonable hours to the laboratories and standardizing instruments of those so furnishing such current for the purpose of checking and testing the accuracy of the instruments used by them in testing meters of the various consumers.

SEC. 15. Section 119 to section 135, both inclusive, of the revised ordinances of Kansas City are hereby repealed.

SEC. 16. All ordinances, or parts of ordinances in conflict with this ordinance, are in so far as they so conflict, hereby repealed.

Approved, October 12, 1910.

LOS ANGELES, CALIF.

[Ordinance No. 22334 (new series).]

The Mayor and Council of the city of Los Angeles do ordain as follows:

SEC. 3. Every electric lamp used or supplied to any customer by any person, firm, or corporation engaged in the business of supplying electric light or electric current for lighting purposes to the city of Los Angeles or its inhabitants for use with the current

so supplied shall be plainly marked with the voltage at which it is intended to be used, and with the candlepower of the light given thereby, at said voltage; and the voltage of electric current supplied by any such person, firm, or corporation to any customer for use in the lamp so furnished, shall not be more than three per cent greater or less than the voltage for which said lamp is marked; and every such person, firm, or corporation shall plainly mark the main or conductor through which any electric current furnished by such person, firm, or corporation for lighting purposes, is delivered by affixing thereto at the point where such main or conductor is attached to the premises of the consumer of such current a tag or label, bearing in plain figures the voltage at that point of the current supplied by such main or conductor.

SEC. 4. Every meter furnished or installed by any person, firm, or corporation engaged in the business of supplying electric light or electric current for lighting purposes or electricity for heating or power purposes to the city of Los Angeles or to its inhabitants shall be plainly marked on the outside and on the front thereof with the current capacity of such meter, in amperes, and shall also be plainly marked with the meter constant, that is to say, with the factor by which the reading of said meter must be multiplied in order to ascertain the amount of energy registered thereby.

SEC. 5. It shall be unlawful for any person, firm, or corporation engaged in the business of supplying electric current for lighting purposes to the city of Los Angeles or its inhabitants to furnish or supply to any customer for use in any lamp furnished or supplied by such person, firm, or corporation, for use with such current any electric current which is more than three per cent greater or less, in voltage, than the voltage marked upon such lamp, unless such excess or deficiency of voltage could not have been prevented by the exercise of ordinary care or prudence on the part of such person, firm, or corporation, or for any such person, firm, or corporation to fail, neglect, or refuse to mark in the manner prescribed in section 3 hereof, any lamp furnished or supplied by such person, firm, or corporation, to any customer for use with the current supplied by such person, firm, or corporation, or to fail, neglect, or refuse to mark in the manner prescribed in section 4 hereof, any meter furnished or installed by such person, firm, or corporation, or to fail, neglect, or refuse to mark in the manner prescribed in section 3 hereof, the main or conductor through which electric current is furnished; or for any such person, firm, or corporation, or for any agent of any such person, firm, or corporation, knowingly to charge or collect from any person, firm, or corporation for a greater quantity of electric current than has been actually furnished.

SEC. 6. It shall be the duty of the Board of Public Utilities to cause to be made an examination and test of the accuracy, capacity, and condition of any electric meter in the city of Los Angeles, installed and used for the purpose of measuring electric current furnished to the city of Los Angeles, or to any person, firm, association, or corporation therein for lighting, heating, or power purposes, by means of wires or other conductors, suspended or laid along across or in the streets of said city; and to test and measure the voltage of any electric current so furnished at the point where the main or conductor carrying such current is attached to the premises in which said current is used. Such examination, test, and measurement shall be made upon the written request of the person, firm, association, or corporation, receiving and using for lighting, heating, or power purposes the electric current measured through the meter to be tested. After the making of such examination, test, and measurement said board shall cause a certificate, in writing, showing the results thereof, to be delivered to the person, firm, association, or corporation at whose request the examination, test, or measurement is made, and shall deliver to the person, firm, association, or corporation furnishing the electric current through said main and measured by said meter, a duplicate of such certificate. Said certificate shall show the time and place of the examination, the number and make of the meter examined, its capacity in amperes, the percentage and character of error, if any, in the measurement made thereby, and the voltage of the electric current supplied through the said main or conductor at the

point where the same is attached to the premises of the consumer. The Board of Public Utilities shall, and is hereby authorized and empowered to charge and collect a fee of one dollar for making each and every such examination, test, and measurement, payable at the time the written request for the making thereof is received by it, and said board shall cause to be paid into the city treasury of said city, on every business day, all fees collected by it during the preceding business day, for the making of said tests. All moneys so collected and paid into the city treasury by said board shall be placed to the credit of the fund of the Department of Public Utilities.

Approved, April 25, 1911.

[Ordinance No. 23816 (new series).]

The Mayor and Council of the city of Los Angeles do ordain as follows:

SEC. 1. It shall be unlawful for any person, firm, or corporation furnishing gas or electric current to the inhabitants of the city of Los Angeles, or to any portion thereof, to require of and collect from any consumer a deposit of money to be held by such person, firm, or corporation as a guarantee fund for the payment of charges for water, gas, or electric current, a deposit in any case exceeding the following amount:

For each dwelling house consisting of 4 rooms or less.	\$3. 00
For each dwelling house consisting of not more than 6 rooms and not less than 5 rooms.	4. 00
For each dwelling house consisting of not more than 8 rooms and not less than 7 rooms.	5. 00
For each dwelling house consisting of not more than 10 rooms, and not less than 9 rooms.	6. 00
For each dwelling house containing more than 10 rooms.	10. 00
In all other cases, such deposit shall not exceed the average estimated cost or charge for water, gas, or electric current to be furnished or supplied for the regular period used as the basis for which bills are to be rendered, and in no event shall such deposit exceed the sum of.	20. 00

SEC. 3. In any case when a deposit as provided in section 1 of this ordinance is required of a consumer by any person, firm, or corporation furnishing water, gas, electric current, or telephone service, such person, firm, or corporation shall pay interest thereon to the person making such deposit, or his assignee, at the rate of 5 per cent per annum, such interest to be payable at the time such deposit is withdrawn and to be computed for the period from the time such deposit was made until the time the service of the person making the deposit is discontinued by such person, firm, or corporation, provided, however, that no interest shall be paid on any such deposit that is withdrawn within a period of three months after making the same, nor for any fractional part of a month in which the same is in the hands of such person, firm, or corporation.

SEC. 4. In any case where a building is used for residence purposes, as an apartment house, lodging house, or tenement house, and the water or gas pipes or electric wires have been so constructed therein as to permit of the installation of one general meter for measuring all water, gas, or electric current furnished to such building, the owner or proprietor of such building shall have the right to demand, and such demand being made in writing, it shall be the duty of the person, firm, or corporation supplying water, gas, or electric current thereto to furnish and install such meter at his or its own cost and expense, and whenever such meter is so installed, such owner or proprietor may install separate submeters for consumers in such house, but such submeters shall be installed at his own cost and expense provided, however, that the provisions of this section shall not apply to separate buildings owned or conducted by the same person as hotels, lodging or apartment houses, nor to rooms in any one building occupied separately for other than dwelling or lodging apartments.

Approved, December 1, 1911.

LOUISVILLE, KY.

[No. 214, series 1914.]

AN ORDINANCE ⁴⁸ Providing for the appointment of an inspector of gas and electricity and prescribing his duties and compensation.

Be it ordained by the General Council of the city of Louisville:

SEC. 1. *Appointment of inspector.*—That the mayor of the city of Louisville at the beginning of his term as mayor is hereby authorized and empowered to appoint, subject to the approval of the board of aldermen, a competent person as inspector of gas and electricity who is qualified and recommended to the mayor as hereinafter provided.

The inspector, his deputies or his clerk, shall not be pecuniarily interested either directly or indirectly in the manufacture or sale of gas or electricity, meters, or any article or commodity used by gas or electric light companies, or used for any purpose connected with the consumption of gas or electricity.

The inspector, his deputies or his clerk, shall not give certificates or written opinions to the maker or vendor of any such article or commodity.

The board of public works and the city engineer shall constitute a board for the examination of all persons who shall apply for the position of inspector. Said board shall give public notice of the time and place of such examination by insertion in the daily papers or otherwise as said board may direct. At the time and place so fixed the board shall examine all applicants in such manner as it shall deem necessary to determine their technical knowledge and competency to perform all duties of inspector as called for in this ordinance. Said board shall within two weeks after such examination certify to the mayor the names of such persons as said board shall deem fully competent to make the tests required in this ordinance. Only persons whose names are so certified shall be eligible to be appointed inspector. Provided, however, that any person who shall previously have held the office of inspector under this ordinance may be reappointed to said office without such certificate from the board; provided also that a person who has once been certified as competent by said board shall be subsequently eligible for appointment without again being examined thereby during a period of four years from such first examination.

SEC. 2. *Term of office of inspector.*—Before entering upon the duties of said office said inspector shall take the oath of office such as required by other city officials and shall give bond, to be approved by the mayor and general council, in the sum of five thousand (\$5,000) dollars for the faithful performance of his duties.

He shall receive a salary at the rate of three thousand (\$3,000) dollars per annum, payable monthly in like manner as the salaries of other city officers and employees.

He shall serve for a term of four years, but said inspector may be removed by the mayor at any time upon written notice to that effect giving his reasons for such action.

SEC. 3. *Deputies and clerk.*—The inspector, with the consent and approval of the mayor, may appoint not more than two deputy inspectors. Each of said deputies shall be competent to perform any and all tests herein provided for which he shall be required or directed to make. Said deputies so appointed shall have the power under the direction of the inspector to perform any duty which may be required of the inspector under the provisions of this ordinance.

The inspector, with the consent and approval of the mayor, may also appoint an assistant or clerk, who need not necessarily be competent to make the tests herein provided for, but who shall under his direction aid in the performance of the duties of this office. Said deputies and clerk shall take the oath of office such as is regularly required of other city officials, and shall give bond in the sum of two thousand five hundred (\$2,500) dollars for the faithful performance of their duties. Said deputies

⁴⁸ Sections relating entirely to gas service are here omitted.

and clerk shall hold office for a term of four years, but shall be removable at any time at the pleasure of the mayor.

Each of said deputy inspectors shall receive a salary at the rate of one thousand five hundred (\$1,500) dollars per annum, payable monthly. The clerk shall receive a salary of one thousand two hundred (\$1,200) dollars per annum, payable monthly.

SEC. 4. *Duties of inspector.*—(1) The inspector shall test or determine as hereinafter prescribed the quality and pressure of all gas and the voltage of electricity furnished by any gas or electric company operating in the city of Louisville and the accuracy of gas and electric meters. He shall have full charge and control of all testing stations, laboratories, and offices provided for his use for such testing and for the keeping of records.

(2) He shall examine and, subject to the action of the board of public works, approve all rates filed with the board of public works or charged by any gas or electric company.

(3) He shall receive and investigate complaints regarding the quality of the gas, gas pressure, electric voltage, and the accuracy of gas and electric meters, and when so requested shall promptly report the result of said investigation to the party complaining and to the company involved.

(4) He shall keep at his office a record of all tests and calculations and formal complaints, which shall be preserved complete and correct, including all tests of gas quality and pressure, of electric voltage, and of all gas and electric meters examined.

(5) He shall make a monthly report of the tests made as to candlepower, heating value, impurities, and pressure of gas, and the electric voltage and the tests made of gas and electric meters. One copy of said report shall be sent to the company concerned, one to the board of public works of the city of Louisville, and the whole report or an abstract of said report may be published by the board of public works in the official papers of the city of Louisville. The inspector shall also render to the board of public works each month a statement of the amount due to the city or to the consumers from any gas or electric company for penalties or fees required under this ordinance or the franchises of said gas or electric companies.

(6) The inspector shall make a special report to the mayor, and to the board of public works, whenever the quality or pressure of the gas or voltage of electricity shall be shown by tests not to conform to the requirements of this ordinance or the franchises of the gas and electric companies. The substance of said special report shall be communicated to the company by the inspector immediately upon the delivery of same to the mayor after completion of the test which showed such condition to exist.

(7) He shall perform any and all other duties naturally connected with this office as required or implied by any part of this ordinance, or any existing or future franchise, or as specially assigned to him at any time by the mayor or the general council.

SEC. 5. *Testing stations.*—(1) As soon as practicable after the passage of this ordinance the city shall provide and maintain testing stations and shall equip and maintain the same with such apparatus and supplies as may be needed for carrying out the provisions of this ordinance. One of said stations shall be located at the city hall and others may be established at or near centers of gas consumption, and if possible shall not be less than one mile, nor more than two miles, measured in a direct line, from any manufacturing plant of the company or companies furnishing gas in the city of Louisville. The company or companies shall run special service pipes for gas and wiring for electricity into each of said testing stations, the same to be of such size and installed in such manner as may be directed by the inspector; provided that the company or companies shall be allowed to so protect these service pipes for gas as to prevent their exposure to temperature lower than those of the gas-supplying mains.

(2) (Omitted.)

(3) One of said testing stations shall be equipped by the city with approved standard electricity meters and other necessary appliances and apparatus which the inspector

may require for the testing of electricity meters, voltage regulation, and in general carrying out the provisions of this ordinance.

SEC. 6. *Method of testing.*—The methods of testing the quality and pressure of said gas and the voltage of electricity and the accuracy of gas and electric meters shall be those set forth in the latest circular of the National Bureau of Standards of the Department of Commerce, or according to the best practice.

SEC. 7. *Gas meters and gas-meter testing.*—(Omitted.)

SEC. 8. *Electric meters and electric-meter testing.*—(1) The company shall have available suitable working standards for the testing of electric service meters, and shall maintain these standards correct within one-half of 1 per cent, or apply the proper corrections to all tests made with them. Each standard shall at all times be accompanied by a certificate giving the date it was last checked, the correction to be applied at various loads, and signed by the proper authority. These certificates, when superseded, shall be kept on file in the company's office, and be kept open to inspection by the inspector at any time.

(2) Every electric service meter shall, within thirty days after being installed by the company on any consumer's premises, be checked by the owning company for correct electrical connections, mechanical condition, proper and suitable location, and accuracy of adjustment and registration at approximately one-tenth and three-fourths of the rated capacity of the meter, commonly called light load and heavy load. All meters so checked and found in error in excess of 1 per cent, in comparison with approved suitable standards, shall be adjusted to register correctly to within 1 per cent at both light and heavy load.

(3) All electric service meters installed upon consumers' premises shall be periodically tested, and if found in error more than 1 per cent at light load or heavy load be adjusted to register within 1 per cent by the owning company in accordance with the following schedule:

(a) *Direct-current meters.*—Meters of rated capacity up to and including 25 amperes shall be tested at least once in eighteen months.

Meters of rated capacity exceeding 25 amperes up to and including 500 amperes shall be tested at least once in every twelve months.

Meters of rated capacity exceeding 500 amperes shall be tested at least once in six months.

(b) *Alternating-current meters.*—Single-phase meters of rated capacity up to and including 25 amperes shall be tested at least once in every thirty months.

Single-phase meters of rated capacity exceeding 25 amperes shall be tested at least once in every twenty-four months.

Polyphase meters of rated capacity up to and including 150 amperes shall be tested at least once in every twenty-four months.

Polyphase meters of rated capacity exceeding 150 amperes shall be tested at least once every twelve months.

(4) The company shall, after the passage of this ordinance, take such steps as may be approved by the inspector to test all its meters according to the schedules herein set forth. All tests made at time of installation and all periodic tests of electric meters shall be subject to such supervision by the inspector as he may deem necessary to insure that provisions of this ordinance are complied with.

(5) Upon formal application by any consumer to the inspector a test shall be made of the consumer's electric service meter by the inspector, such test to be made as soon as practicable after receipt of application. For such test a fee of fifty cents shall be paid by the consumer at the time the application is made for the test; this fee to be retained if the meter is found to be slow or incorrect within 4 per cent as averaged at light load and heavy load. If the meter is found to be more than 4 per cent fast as averaged at light load and heavy load the company shall pay to the consumer the fee of fifty cents, and further the company shall refund to the complaining consumer

such a percentage of the amount of the bills for the previous three months, or for the time the meter was in service, not exceeding three months, as the meter was found to be in error at the time of the test.

If the meter is found to be more than 4 per cent slow, as averaged at light load and heavy load, the company may charge to the complaining consumer such percentage of the amount of the bills for the previous three months, or for the time the meter was in service, not exceeding three months, as the meter was found to be in error at the time of the test.

(6) The company owning any meter on which the inspector is about to make a test upon consumer's complaint shall be notified by the inspector that such test is to be made, and should have a representative present to open the meter, and if necessary to adjust the meter to within the required limits of 1 per cent at light load and heavy load, and to seal the meter after completion of test and adjustment.

(7) The installation, removal, installation and periodic tests, and adjustments, and transportation of meters, shall be at the expense of the company owning the meters.

SEC. 9. *Gas pressure.*—(Omitted.)

SEC. 10. *Variation of voltage and voltage surveys.*—(1) The company shall adopt a standard voltage for its entire constant potential system, or for each of the several districts into which the system may be divided, and shall maintain such a voltage, as measured at any consumer's cut-out by a standardized indicating voltmeter, so that variations of more than 3 per cent above or 3 per cent below such standard voltage shall not occur between sunset and 11 o'clock p. m. for periods exceeding five minutes on lighting circuits. On other than exclusively lighting circuits variations of more than 10 per cent above or 10 per cent below the standard voltage shall not occur at any time for periods exceeding five minutes; provided, however, that variations in voltage caused by the operation of apparatus on the consumer's premises, in violation of the company's rules, the action of the elements, or other causes beyond the company's control, shall not be considered a violation of this section.

(2) The company shall provide itself with one or more portable indicating volt meters and one or more graphic recording voltmeters, these instruments to be of a type and capacity suited to the voltage supply.

The company shall make a sufficient number of voltage surveys to indicate the service furnished from each feeder and to satisfy the inspector of its compliance with the voltage requirements, and shall keep one or more graphic recording voltmeters in continuous service at its plant, office, or some consumer's premises. All voltmeter records shall be kept open for public inspection.

SEC. 11. *Quality of natural gas.*—(Omitted.)

SEC. 12. *Records of the company.*—The company shall maintain complete and correct records as prescribed hereinafter and shall allow free access to said records at all reasonable hours to the inspector, deputy inspector, clerk, or other city official who may be authorized by the general council to have such privilege. The records shall include the following:

(1) Record of all consumers purchasing gas or electricity from the company and the number of the meter or meters in use by each.

(2) Records of all the meters owned by the company, with the date of their purchase, and a record of the use, tests, and repairs to which each has been subjected, with the result of each testing, and the location of each meter.

(3) Record of all complaints made to the company regarding (a) the quality of gas, (b) the pressure of the gas, (c) the voltage of electricity, and (d) the accuracy of meters, both gas and electric, and the record of the method of disposal of each of said complaints.

(4) Record, with the necessary maps and charts, of all gas mains, gas service pipes, governors and other connections or appliances owned and used by the company in the

distribution of gas, and all mains, cables, wires, etc., used in the distribution of electricity.

SEC. 13. *Complaints.*—The company shall make a reasonable investigation of all complaints made to it by the inspector or by any consumer, and shall promptly make all such changes, alterations, or additions to its methods or apparatus and equipment as may be necessary in order that the quality and pressure of the gas and the furnishing of electric current shall be such as is required by the provisions of this ordinance and any existing franchise for furnishing gas and electricity in the city of Louisville. When requested by any complainant the company shall inform said complainant as to the results of the investigation of his complaint, stating the cause of the difficulty and the approximate time when it will be corrected.

SEC. 14. *Penalties.*—The company shall be subject to and shall pay to the city of Louisville upon conviction a penalty of the amounts set forth below whenever and as often as it shall violate the respective provisions of this ordinance, it being understood that the penalties herein enumerated are not to waive or in any way lessen the rights of the consumers of the city of Louisville or the city of Louisville as fixed in the ordinances and franchises granted to such offending companies or persons.

(1) to (7) (Omitted.)

(8) In case that any gas or electric meter is installed or allowed to remain in service without test contrary to the provisions of this ordinance without the written permission of the inspector for such installation or for the omission of such test, a fine of \$50 for each meter so installed or so left without test.

(9) In case that any person, firm, or corporation, or any employee of any person, firm, or corporation engaged in furnishing gas or electricity to consumers, shall misread any meter in favor of any corporation, firm, or individual furnishing said article, or shall falsely report the reading of any meter, a fine of not less than \$50 nor more than \$100 for each offense.

(10) In case that any person, firm, or corporation engaged in the manufacture or distribution of gas or electricity in the city of Louisville shall fail or refuse to prepare, maintain, or disclose such records as they are required to do by the provisions of this ordinance, such person, firm, or corporation, its managing officers and agents, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be punished by a fine of not less than \$15 nor more than \$100, and each day that any person, firm, or corporation shall fail to comply with the provisions in reference to the records of said company shall be deemed a separate offense.

(11) In case that the company shall fail to make a reasonable investigation of all complaints made to it by the inspector herein, or by any consumer, or to promptly make all changes, alterations, or additions to its methods or apparatus and equipment as may be necessary hereunder, or shall fail to carry out the provisions of section 13 hereof, a fine of not less than \$50 nor more than \$100, and each day's failure or refusal to conform to the provisions of said section after notice in writing by the inspector shall be deemed a separate offense.

(12) In case that any company furnishing electricity in the city of Louisville shall fail or refuse to maintain the voltage required herein, a fine of not less than \$50 nor more than \$100 for each day, and each day of said failure or refusal to maintain said voltage after notice from the inspector herein shall constitute a separate offense.

SEC. 15. If any person, firm, or corporation violates any provisions of this ordinance for which a penalty is not specifically provided for herein, said person, firm, or corporation shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined not less than \$10 nor more than \$100, and each day's continuance of said violation after notice in writing by the inspector herein shall constitute a separate offense.

SEC. 16. The word "company" as used in this ordinance shall be construed to include any person, firm, or corporation engaged in the manufacture and distribution of gas or electricity, or both, as the case may be, in the city of Louisville or to its citizens for compensation.

SEC. 17. Nothing in this ordinance shall be deemed or construed to be a waiver by the city of Louisville of any provision in any franchise in its favor or in the favor of any consumer of gas or electricity.

SEC. 18. The ordinance entitled "An Ordinance providing for the appointment of a city gas inspector and prescribing his duties and compensation," approved April 7, 1908, is hereby repealed.

SEC. 19. This ordinance shall take effect from and after its passage.

Approved June 3, 1914.

MEMPHIS, TENN.

SEC. 13. *Be it further ordained*, That any person desiring to have an electric current meter or meters inspected shall notify the interior electrical inspector, and make a deposit with him of \$3 for each meter desired to be inspected. Said inspector shall thereupon inspect said meter, or have it inspected, and shall report in writing to the person requesting said inspection the condition of the meter. If said meter is not more than 3 per cent fast, the said interior electrical inspector shall deduct from the sum deposited with him the sum of one dollar for each meter examined, and the expense of said examination, if any of said meters were disconnected, and pay the balance to the party requesting said inspection. If said meter or meters are more than 3 per cent fast, then the electric light company furnishing said meter or meters shall pay the fees for examining any such meters as are more than 3 per cent fast, and the extra deposit made by the party desiring such inspection shall be refunded to him. Said interior electrical inspector shall embody in his monthly and annual reports a statement of the meters examined, and the conditions thereof, and shall pay all fees thus collected weekly to the city clerk.

SEC. 14. *Be it further ordained*, That the Board of Commissioners shall annually, upon the nomination of the Commissioner of Public Utilities, Grounds and Buildings, elect an interior electrical inspector and an assistant interior electrical inspector, who shall be electricians of at least five years' experience on interior wiring and qualified under the state laws. They shall give bond in the sum of \$2,000 each to faithfully perform their duties, and their salaries shall be such sums not to exceed \$1,500 each, as shall be determined by the Board of Commissioners before their election.

Approved February 11, 1910.

MINNEAPOLIS, MINN.

AN ORDINANCE Relating to the inspection and testing of electric meters in the city of Minneapolis.
The City Council of the city of Minneapolis do ordain as follows:

SEC. 1. It shall be the duty of the inspector of gas of the city of Minneapolis, when requested, to inspect, examine, and test any and all meters used in the city of Minneapolis for measuring and ascertaining the quantity of electricity or electric energy or power furnished by any person, persons, company or corporation to users and consumers of electricity or electric energy or power in the city of Minneapolis. Such examination and test of electric meters shall be made by said inspector of gas with standard measuring instruments and apparatus to be furnished by the city council.

SEC. 2. Any user or consumer of electricity or electric energy or power within the city shall have the right, upon paying to said inspector of gas a fee of fifty cents for each meter, to have his electric meter or meters inspected and tested by said inspector of gas; but the person, company or corporation furnishing any electricity or electric energy or power to such user or consumer thereof shall have due notice of the time and place where such examination and test is to be made. A meter shall be deemed to be correct if it appears from such examination and test that it does not vary more than two and one-half per cent fast or slow from the quantity actually used as indicated by said standard measuring instruments and apparatus.

If upon such examination and test a meter is found to be correct, said inspector of gas shall seal or mark the same with some suitable device, but if upon such examination and test it appears that the meter does not register correctly, said inspector of gas shall order the person, company or corporation furnishing such meter to remove the same and to substitute therefor a correct meter.

SEC. 3. If upon such examination and test, at the request of the user and consumer of electricity, a meter is found to be incorrect because too fast and registering more than two and one-half per cent in excess of the quantity actually used, as indicated by said standard measuring instruments and apparatus, said fee of fifty cents paid for such examination and test shall be refunded to the person paying the same, and such inspection fee of fifty cents shall be paid to said inspector of gas by the person, company or corporation furnishing electricity or electric energy or power to such user and consumer thereof. All moneys received by said inspector of gas as fees for examination and test of electric meters under this ordinance shall be paid by him into the city treasury daily.

SEC. 4. This ordinance shall take effect and be in force from and after January 1, 1907.

Approved August 1, 1906.

NEW ORLEANS, LA.

[Act No. 35. House Bill No. 198.]

To amend Act No. 159 of the General Assembly of the State of Louisiana, regular session of 1912, incorporating the city of New Orleans, so as to create and establish a Board of Public Utilities and empowering said board to adopt and enact any and all just reasonable and adequate rules and regulations for the supervision and regulation of service of public service utilities within the said city; to establish standards of service, commodity, charges, and measurements thereof * * *.

SEC. 1. To establish reasonable rates, tolls, and charges, including a minimum charge, for electrical energy and service supplied by corporations and other agencies generating the same; to provide the means for correct and accurate tests for all meters measuring the quantity of said electrical energy supplied; to require the extension of electrical distribution systems under reasonable terms and conditions to such districts of the city as are sufficiently populous to insure reasonable revenue returns to the corporation or agency ordered to extend the same.

Approved June 26, 1916.

NORFOLK, VA.

AN ORDINANCE Providing for the inspection of gas meters and electric meters.

Be it ordained by the Council of the city of Norfolk, Virginia, as follows:

SEC. 1. That in addition to the present duties of the Superintendent of Electrical Affairs (city electrician) and without extra compensation therefor, he shall, under the direction and control of the Board of Control, make accurate and impartial inspections and tests of gas meters and electric meters in the city of Norfolk.

SEC. 2. No corporation or person shall furnish or put in use any gas meter which shall not have been inspected, proved, and sealed, or any electric meter which shall not have been inspected, approved, stamped, or marked by said superintendent of electrical affairs, for which service the corporation owning such meters shall pay into the city treasury the sum of 25 cents for each meter so inspected.

SEC. 3. Every gas and electric corporation furnishing gas or electricity for use in the city of Norfolk shall provide and keep in and upon its premises a suitable and proper apparatus, to be approved and stamped or marked by the Board of Control for testing and proving the accuracy of gas and electric meters furnished by it for use, and by which apparatus every meter may and shall be tested, on the written request of the

consumer to whom the same shall be furnished, and in his presence, if he desires it, as hereinafter provided.

SEC. 4. Whenever request for the inspection and test of any gas or electric meter shall be made to the Board of Control by or on behalf of the person on whose premises the meter is installed, and such person shall have paid into the city treasury a fee of \$1 therefor, the said Superintendent of Electrical Affairs shall be required to make an immediate inspection and test of such meter and to report the result thereof to the said board. Should such meter be shown by such test to be correct within 4 per cent if an electric meter and to be correct within 2 per cent if a gas meter, then and in that event the meter shall be considered as standard and the \$1 so paid shall remain in the city treasury and the consumer shall bear the expense of said test. If, however, said test shall show the meter to be more than 4 per cent fast, if an electric meter, or 2 per cent fast, if a gas meter, which percentage of error will be registering against and to the prejudice of the consumer, the Superintendent of Electrical Affairs shall order the gas or electrical corporation forthwith to remove the same and to place instead thereof a correct meter, approved by said superintendent as provided in section 2, and the deposit of \$1 shall be returned to the person requesting the inspection and test, and said inspection fee shall be paid into the city treasury by the corporation owning said meter; should the meter be registering more than 4 per cent slow if an electric meter, or 2 per cent slow if a gas meter, then in that event the fee of \$1 shall be borne by the parties requesting the inspection.

SEC. 5. All bills against the corporations owning gas or electric meters for inspection fees shall be reported to the Board of Control, who shall cause warrants for collection to be made out against said corporations for said amounts.

SEC. 6. Any person, firm, or corporation who shall violate any provision of this ordinance or fail to comply with any order of the said superintendent to remove a defective meter and place instead thereof a correct meter, as provided for in section 4 of this ordinance, shall pay a fine of not less than \$1 and not more than \$10 for each offense, and each day's continuance of such violation or failure to comply shall be deemed a separate offense.

SEC. 7. This ordinance shall be in force from and after its passage and due publication, and all ordinance in conflict herewith are hereby repealed.

Approved March 19, 1913. In effect March 29, 1913.

PROVIDENCE, R. I.

It is ordained by the City Council of the city of Providence as follows:

SEC. 13. Said engineer is hereby empowered to make and from time to time shall make examinations and tests to determine, and shall determine the quality, pressure, voltage, and character of the product furnished in the city by public service companies supplying currents of electricity or gas for light, heat, or power.

Chap. 533. No. 281. Approved July 24, 1912.

"The Franchise Agreement between city of Providence and the Narragansett Electric Lighting Co.," Article V, section 1, provides:

Except under abnormal or unusual conditions the electricity sold by either party to the other under this agreement shall not vary in frequency more than five (5) per cent above or below 60 cycles, and the voltage of such electricity shall not vary more than five (5) per cent above or below eleven thousand (11,000) volts.

SANDUSKY, OHIO.

SEC. 2. All metered services shall be supplied with meters of a high grade, of a quality equal to those manufactured by the Westinghouse Elec. & Mfg. Co., or the General Electric Co. All meters shall be sealed by the company, and in order that

the city meter inspector, or anyone acting in that capacity by authority of the city, shall be able to inspect or test any of said meters, the company, shall at any time, upon direction of the Director of Public Service, remove such particular seals as may be necessary for such purpose. In case it is necessary to remove the meter for purpose of such inspection or test, the said company shall substitute other meters immediately, so as to avoid interruption of service. Written notice shall be filed daily by the company in the office of the Director of Public Service or other similar office of the city, of all meters disconnected or removed, with a statement of the reasons for such disconnections or removal. The company shall not remove from service any meter, when notified not to do so by the Director of Public Service, or anyone acting in that capacity by authority of the city, and shall not disturb such meter until said notice is duly cancelled by the Director of Public Service. But in any event, the inspection and test of meters so held, on notice by the Director of Public Service, shall be completed by him or his representative within 15 days from date of such notice, after which date, unless previously cancelled, the company shall have the right to deal with such meters as in the case of ordinary business. All meters must be accurate through the entire range of their load within 3 per cent.

If a consumer believes a meter that has been inspected and tested in the regular course of inspection by the city, to be incorrect, he may again have the same tested upon making written application accompanied with a deposit fee of 50 cents to the Director of Public Service or other officer of the city acting in that capacity; whereupon, after notice to the company his meter shall be again tested and inspected, and if the meter is found to be correct, the consumer shall forfeit his 50 cents deposited to the city. If the meter is found to be incorrect, that is, recording too high, the said company shall pay to the consumer the amount of said deposit and rebate to the consumer the amount of excess charges due to the high record for a period not exceeding two (2) months to said complaint.

In case of a disagreement between the city meter inspector, or anyone acting in that capacity, by authority of the city, and the said company relative to the accuracy of testing instruments and tests, either party may demand that the meter or testing instruments be sent to a testing laboratory of established reputation for checking and the party in error shall pay the expenses thereof.

SEC. 3. All electricity furnished shall be of a voltage sufficiently uniform so that there shall be no notice of variation in the light given by an incandescent light and shall be furnished for lighting at either 110 or 220 volts, at the option of the consumer, and for other electric service at such voltage as may be consistent with the apparatus to be used, and to the service of the company, and shall be supplied at a frequency of 60 cycles per second.

SEC. 4. The meters shall be read each month upon such date or dates, covering similar periods, as the company may elect, and the bills of service, based on the results of said readings, may be issued thereafter as soon as practical. Said bills shall show the date of reading the meter, and shall be payable at the office of the company on or before ten days from the date of issue.

The city reserves the right to verify meter readings made by the company for the purpose of determining the amounts of bills for current furnished by making any such meter readings in the presence of the city meter inspector or any other person or persons acting for and by authority of the city.

SEC. 5. The said company shall be required to furnish a suitable badge to its meter readers, meter inspectors, and all employees who are required to enter any building in which the company has electric installations, and shall cause such meter inspectors, meter readers, or other employees to prominently display said badge and furnish other reasonable and proper credentials before entering any buildings, if requested to do so by the owner or occupant thereof.

Approved, 1914.

[Ordinance 881 C.]

* * * The company shall permanently place a card near and convenient to every meter installed for the measurement of electric current for every kind of service, which said card shall have printed thereon the twelve months of the year. Every month when, and as the meter is read, the meter reading shall be written legibly by the meter reader upon said card.

Passed July 12, 1920.

SAN FRANCISCO, CALIF.

ORDINANCE No. 1832 deals with the testing of gas and electric consumer's meters, and requires that such instruments shall be accurate within 2 per cent. In case meter is found to register to the prejudice of consumer the owning company is required to refund upon the basis of meter registration during the three months next preceding the test. Testing is done by an inspector of the City Light and Water Inspection Bureau, and ordinance permits a representative of the owning company to be present during test.

[Light and Water Inspector, May 8, 1914.]

SHREVEPORT, LA.

AN ORDINANCE Creating the office of Gas, Electric, and Water Meter Inspector, defining his duties, and fixing his compensation.

Be it ordained by the City Council of the city of Shreveport, in legal assembly convened, that there be created by the adoption of this ordinance, the office of inspector of gas, electric, and water meters. Be it further ordained that the duties of said office shall be to make inspections of gas, electrical, and water meters in the city of Shreveport when requested in writing to do so by consumers of gas, electricity, or water, having meters on their premises, and of the piping and other appliances from the meters to the jets, gas ranges, lights, faucets, and other points of consumption of gas, electricity, and water; to thoroughly examine and report their condition and to report any leakage, defective construction, or faulty appliances to such consumers.

Be it further ordained that said inspector shall make such inspections within five days after being so requested by said consumer or consumers.

Be it further ordained that said inspector shall be entitled to demand and receive in advance for his services the sum of \$1 payable to him by such consumer requiring his services for the first meter read or the first inspection as aforesaid on his premises, and the sum of 50 cents for each additional meter read, or for each additional inspection of fixtures in appliances connected with other meters on the same premises.

Be it further ordained that all laws or parts of laws in conflict herewith be and the same are hereby repealed.

Be it further ordained that this ordinance shall go into effect and become operative from and after its adoption and promulgation.

Adopted January 14, 1907.

SIOUX CITY, IOWA.

AN ORDINANCE Authorizing the City Engineer of Sioux City, Iowa, to inspect and test electric meters in the city of Sioux City, Iowa, and inspect the arc lamps and lights in the city, providing for the refunding of overcharges to consumers and prescribing for the violation of this ordinance.

Be it ordained by the City Council of the city of Sioux City, Iowa:

SEC. 1. It shall be the duty of the city engineer, and such assistants as he may appoint, with the consent of the City Council, when requested, to inspect, examine, and test, any and all meters used in the city of Sioux City for measuring and ascertaining the quantity of electricity, or electric energy, or power, furnished by any person, persons, company, or corporation, to users and consumers of electricity, or electric energy, or power, in the city of Sioux City. Such examinations and tests of electric meters shall be made by said city engineer with standard measuring instruments and apparatus.

SEC. 2. Any user or consumer of electricity, or electric energy, or power, within the city shall have the right upon paying to said engineer a fee of fifty cents for each meter, to have his electric meter or meters inspected by said engineer, but the person, company, or corporation, furnishing any electricity, or electric energy, or power, to such user or consumer thereof, shall have due notice of the time and place where such examination is to be made. A meter shall be deemed to be correct if it appears from such examination and test that it does not vary more than two (2) per cent, fast or slow, from the quantity actually used as indicated by said standard measuring instruments and apparatus.

If upon such examination and test, a meter is found to be correct, said engineer shall seal or mark the same with some suitable device, but if upon such examination and test it appears that the meter does not register correctly, said engineer shall order the person, company, or corporation, furnishing such meter, to remove the same and substitute therefor a correct meter.

SEC. 3. If upon such examination and test, at the request of the user and consumer of electricity, a meter is found to be incorrect because too fast, and registering more than two (2) per cent in excess of the quantity actually used, as indicated by said standard measuring instruments and apparatus, said fee of fifty cents paid for such examination and test, shall be refunded to the person paying the same, and such inspection fee of fifty cents shall be paid to the city engineer by the person, firm, company, or corporation, furnishing electricity or electric power, or energy, to such user and consumer thereof. All moneys received by the city engineer as fees for examination and test of electric meters under this ordinance, shall be paid by him into the city treasury daily.

SEC. 4. It shall be the duty of all persons, firms, corporations, or individuals, to furnish meters that measure correctly, and if upon such examination and test of a meter, it appears the meter of any consumer does not register correctly, because too fast, and registering more than two (2) per cent in excess of the quantity actually used as indicated by the standard measuring instruments and apparatus, any consumer having been theretofore charged, and having paid for electricity as measured by such meter, shall be entitled to, and shall receive pro rate discount on all his electric bills therefor. The percentage and amount of such discount shall be ascertained on the basis of the total number of months the meter was used by consumer, not exceeding six (6) months, and shall be deducted from the next month's bill, or paid to the consumer in cash. Any refusal or neglect to refund by such persons, firms, corporations, or individuals, shall be a violation of this ordinance.

SEC. 5. All persons, firms, corporations, or individuals, furnishing electric lights in the city of Sioux City, Iowa, shall be required to keep the arc lamp globes clean, free from dirt, or other substance that in any way obstructs the light, and replace broken lamps.

Any failure to do so, for a period of twenty-four hours, shall be a violation of this ordinance.

It shall be the duty of the city engineer, on receiving information, or from inspection, that the persons, firms, corporations, or individuals, have failed to comply with this provision, to enter complaint in the proper court and prosecute the said parties for such failure.

SEC. 6. All persons, firms, corporations, or individuals, furnishing or selling electricity for light or power, may request the city engineer to test and seal, or mark, any meter, and upon being tendered or paid the fee of fifty cents, it shall be the duty of the city engineer or his assistants, to test the meter or meters in the presence of a representative of such persons, firms, corporations, or individuals at such hour as may be arranged, and if the meter does not vary more than two (2) per cent from standard measurement, the engineer shall seal, or mark the meter, and affix a card stating the facts and date of such examination and if found more than two (2) per cent variation, the meter shall not be used again until regulated to record correctly.

SEC. 7. No person other than the city engineer, or his assistants, shall unseal or break the seal of any meter sealed by him, or his assistants, or deface, alter or remove any certificate or card attached to the meter by said engineer or assistant, or place thereon any card purporting to be the certificate of the city engineer.

SEC. 8. All persons, firms, corporations, or individuals, furnishing or selling, electricity for light and power within the city of Sioux City, Iowa, in violation of this ordinance or any provisions thereof, shall on conviction, pay a fine of not less than ten dollars (\$10), nor more than one hundred dollars (\$100), and shall be imprisoned until such fine be paid, not exceeding thirty (30) days.

SEC. 9. All ordinances and parts of ordinances conflicting with any provisions of this ordinance are hereby repealed.

SEC. 10. This ordinance shall take effect and be in force from and after its passage and publication as provided by law.

Passed February 18, 1911.

ST. LOUIS, MO.

[Ordinance 23864.]

SEC. 3C [4th paragraph]. *Electric service of highest quality required.—To furnish incandescent lamps without charge.—To replace burned out fuses.*—The grantee shall furnish to all customers electric service of the highest quality and equal in all respects to that of any company engaged in the city of St. Louis in a similar business, and the nature and voltage of the current delivered shall be such as to operate in the most efficient manner incandescent lamps of the highest efficiency, and all other forms of lamps in commercial use in the United States; and the grantee shall furnish to customers such incandescent and other lamps and shall replace, renew, and maintain the same from time to time, as may be necessary to deliver first-class service, without extra charge. The cost of such lamps and their replacement, renewals, and maintenance shall be included in the price per kilowatt hour for current. The grantee shall maintain on duty, at all times, a sufficient number of skilled men to promptly remedy and shall therewith promptly remedy, interruptions of service, and the grantee shall replace defective or burned out fuses, which shall be done without extra charge to consumers, and shall be included in the kilowatt hour price for current, as hereinbefore provided. Nothing contained in this paragraph (c) shall be construed as requiring the grantee to maintain the customer's inside wiring. Should the customer's service be interrupted by reason of faults in wiring which is the customer's property, then, in that event, the grantee may charge the customer a reasonable price for making the necessary repairs, providing the customer elects to have the grantee do the work for him.

Not to require guarantee of consumer.—Connection service without charge.—The grantee shall not require any customer to guarantee any sum for service, nor exact any rental for service connection or meters, nor in any manner require any customer to guarantee the use of any fixed amount of current in any period of time, nor require any customer to make a deposit in excess of one average month's bill, upon which deposit the grantee shall allow interest to the customer at five per cent per annum. The grantee shall furnish to each customer applying for service, free of charge, a service connection which shall extend from the grantee's street service mains to the inside of the wall of the customer's premises at a point convenient for connection to the grantee's street mains.

Approved October 19, 1908.

TOPEKA, KANS.

[Ordinance No. 2756.]

AN ORDINANCE Creating the office of inspector of meters, etc. (prescribing the duties thereof, and providing for the inspection and testing of all electric, steam heat, gas, and water meters used within the city of Topeka, regulating the use of the same and establishing a fee to be paid for the inspection thereof).

Be it ordained by the Mayor and Councilmen of the city of Topeka:

Inspector of meters created. 1.—There is hereby created the office of inspector of meters of the city of Topeka, and from and after the passage and taking effect of this

ordinance the inspector of plumbing of the city of Topeka shall, by virtue of his office, be inspector of meters for the city of Topeka, and he shall, in addition to the duties already enjoined upon him as inspector of plumbing, do, and perform all the duties of the office of meter inspector as hereinafter provided.

Duties. 2.—It shall be the duty of the inspector of meters of the city of Topeka to inspect, test, and correctly adjust all meters used within the city of Topeka, for the measurement of electric current, steam heat, gas, and water; and said meter inspector shall promptly, at the expense of said city, equip and maintain a testing room for the correct inspection and testing of all such meters as he is called on to inspect or test, in the manner hereinafter provided.

Test of meters; fee. 3.—Upon the application of any consumer of electric current, steam heat, gas or water for a test of any meter through which electric current, steam heat, gas, or water is supplied to him, said consumer shall deposit with said meter inspector one dollar, and take his receipt therefor. Whereupon said meter inspector shall inspect, and, if necessary, remove said meter to the testing room of said city. It shall be the duty of said meter inspector to test and correctly adjust, seal, and replace any meter so removed, within three hours after its receipt at said city testing room. Should the meter inspector find any such meter slow or not to exceed three per cent fast he shall pay to the city treasurer the one dollar deposited by the consumer, as aforesaid, and take the city treasurer's receipt therefor; but, should he find the meter incorrect in excess of three per cent fast, the meter inspector shall return said money to the consumer and take its receipt therefor, and the meter inspector shall collect from the owner of any electric, steam heat, or gas meter the sum of one dollar, pay the same into the city treasury, and take a receipt therefor.

The person, company, or corporation furnishing service through any meter of which any such test is to be made shall be given due notice in writing of the time and place of making such test, and such party shall have the privilege of being present in person or by a representative when the test is made.

Meters; repaired; replaced. 4.—If any meter thus tested can not be adjusted by the meter inspector, it shall be returned to the owner and repaired or replaced by a correct meter.

Bills; adjustment. 5.—If any electric, steam heat, gas, or water meter is found on test to be fast or slow in excess of three per cent, the bill for service for the preceding thirty days shall be adjusted by adding to or subtracting from such bill the percentage, fast or slow as the case may be, and the difference thus determined shall be paid to the consumer by the party furnishing service, or to the party furnishing service, by the consumer, as the case may be.

Meter reading charts. 6.—It shall be the duty of the meter inspector to prepare meter reading charts, showing the meter dial face, with a sample meter reading thereon, and a full explanation of the process of arriving at the amount of the customer's bill, together with such other instructions as will enable the consumer to read his own meter.

Testing instruments; test of. 7.—All testing instruments used by the meter inspector shall be tested and made to conform to the standard measurements at least once a month, or as often as may be necessary to secure accurate and reliable tests.

The meter inspector shall keep on file in his office a record of all tests made.

Take effect. 8. This ordinance shall take effect and be in force from and after its publication in the official city paper.

WILMINGTON, DELAWARE.

Laws of Delaware, 1911, volume 26, chapter 206, public-utility commission. An act to create a board of public-utility commissioners for the city of Wilmington and prescribe its duties. Approved March 29, 1911.

VI. SUGGESTED ORDINANCES FOR THE REGULATION OF ELECTRIC SERVICE IN TOWNS AND CITIES.

The bureau has had requests from a number of cities for information with reference to the regulation of electric and gas utilities, and has given such information and assisted in the framing of regulatory ordinances.

Such ordinances must be framed so as to meet local conditions and be in harmony with existing franchises. Nevertheless the requirements for safe and adequate service are much the same everywhere in cities and towns of comparable size, and it is hence possible to frame a model city ordinance which, with such modifications as local conditions may require, would be applicable in a great many different places.

It seems desirable to propose model ordinances in three forms—one applicable to small cities and towns, one applicable to cities generally, and one applicable more particularly to the larger cities. In many cities the testing and inspection of meters and service can not in general be done by the municipal authorities on account of the expense involved, while in others such inspection, testing, and supervision by a municipal officer is practicable and usual. This is the fundamental difference in the suggested ordinances, the one for small cities and towns simply suggesting what should be aimed at by the utility as to standards of service.

Towns and cities in States having public-service commissions with wide regulatory powers generally need no such ordinances, the jurisdiction and authority of the commission being in most instances ample to regulate gas and electric service. In some States, however, no commission regulation has been provided for, or the matter has not yet been considered by the existing commission, and for such towns and cities the proposed ordinances may be of interest and value.

In this connection attention may be called to certain interesting differences in the jurisdiction of State commissions with reference to the regulation of gas and electric service in cities. In the State of California—

Any city or county, or incorporated city or town, may retain its powers of control vested therein respecting any one or more classes of public utilities and may thereafter surrender such powers to the railroad commission of the State of California, hereinafter called the railroad commission, or may reinvest itself with such powers as it may have surrendered to the railroad commission, all as in this act provided.⁴⁹

⁴⁹ Sec. 1, Hewitt election act, statutes of 1911, extra session. Approved Jan. 2, 1912.

In Kansas the public-utilities act provides that—

Every municipal council or commission shall have the power and authority, subject to any law in force at the time, to contract with any public utility or common carrier, situated and operated wholly or principally within any city or principally operated for the benefit of such city or its people, by ordinance or resolution, duly considered and regularly adopted: (1) As to the quality and character of each kind of product or service to be furnished or rendered by any public utility or common carrier.⁵⁰

Upon complaint by any public utility or by 10 or more taxpayers to the commission with reference to such ordinance or resolution within 15 days of its publication the public-utilities commission—

May inquire into the allegations in such complaint, and may subpoena witnesses and take testimony to ascertain the truth of the allegations * * *; and if said commission shall find that any provision of any such ordinance or resolution is unreasonable or against the public welfare or public interest, or has reason to believe that the same may be contrary to law, said public-utilities commission shall, within 10 days, advise and recommend such changes in the ordinance or resolution as may be necessary to meet the objections set forth in the complaint and protect the public interest * * *.

In Arkansas the recently amended act abolishing the Corporation Commission and establishing a Railroad Commission, provides that:

Nothing herein shall vest said commission with jurisdiction as to any rate, charge, rule, regulation, order, hearing, investigation, or other matter pertaining to the operation within the limits of any municipality of any * * * gas or water, electrical company, * * * hydroelectric company, or other company operating a public utility * * *.

1. FOR TOWNS AND SMALL CITIES.

AN ORDINANCE Prescribing rules and regulations for electric service in the city of ——— and prescribing penalties.

The mayor and council do ordain as follows:

Section 1. Adequate plant equipment.—Each company furnishing electrical energy for light, heat, or power in the city of ——— shall have and maintain its plant, equipment, and facilities in such condition as will enable it to furnish, as far as practicable, safe, adequate, and continuous service to its customers within its hours of operation.

Sec. 2. Meter equipment.—(a) Each company furnishing metered electric service shall install and maintain its meters on customer's premises free of charge.

(b) No watthour shall be placed in service which "creeps"—that is, registers on no load—or which has incorrect constants or is in any way mechanically defective. All meters either before,

⁵⁰ Laws of 1911, chap. 238, sec. 33.

or within 60 days after, installation shall be tested and adjusted so as to register correctly to within plus 2 or minus 4 per cent and to within 2 per cent plus or minus at approximately one-tenth and three-quarters, respectively, of the rated capacity of the meter. A meter creeps when with all load wires disconnected the moving element makes one complete rotation in five minutes or less.

(c) Each company shall have available standard portable watthour meter or meters of types and capacities suited to testing its service meters and at least one portable indicating voltmeter and one curve-drawing voltmeter of suitable capacities. The curve-drawing voltmeter should be kept in service on the company's lines continuously.

Sec. 3. Tests of meters.—Each company shall test all of its service watthour meters on customer's premises at least once every 24 months, if direct-current meters, and once every 36 months, if alternating-current meters. After test each meter shall be adjusted to register correctly as specified in section 2 hereof.

Sec. 4. Continuity of service and voltage regulation.—Each company shall make every reasonable effort to maintain continuous and uninterrupted service during its service hours and to maintain a constant voltage on its service lines as closely as possible. The maximum voltage variation from the established standard nominal voltage as measured at the company's service terminals should not exceed 5 per cent above or 5 per cent below such standard nominal voltage during lighting hours, and the total variation of voltage from minimum to maximum should not exceed 8 per cent of the nominal voltage.

Sec. 5. Bills to customers.—Bills rendered to customers periodically for electric service shall show the total kilowatthours charged for, the net amount due, the dates on which the readings were taken, the readings of the meter at the beginning and end of the interval for which the bill is rendered, if requested by the customer, and all the other essential facts upon which the bill is based.

Sec. 6. Complaints.—(a) Each company shall make an investigation of all reasonable complaints made to it by its customers and shall upon request, without charge, test customers' meters for accuracy of registration provided such requests are not made oftener than once a year.

(b) If any test made upon a customer's complaint shows his meter, in comparison with suitable testing standards, to be in

error to the prejudice of the customer in excess of 4 per cent, as averaged at light and heavy load, the company shall refund to the complaining customer an amount equal to the excess charged for the kilowatthours incorrectly metered over a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months.

Sec. 7. Records.—Each company shall keep a record of all its customers and the meter or meters installed on each customer's premises. A record of all meters shall be kept also which shall show the results of tests on each meter for at least five years.

Sec. 8. Penalties.—Each company shall be subject to and shall pay to the city of ———, upon conviction, a penalty of ——— dollars whenever and as often as it shall violate any provision of this ordinance, it being understood that the penalty herein fixed does not waive or in any way lessen the rights of the customers in the city of ———, or of the city of ———, as fixed in ordinances and franchise granted to the company.

2. FOR CITIES GENERALLY.

AN ORDINANCE Prescribing rules and regulations for electric service⁵¹ in the city of ——— and prescribing penalties for violations of such rules and regulations.

The mayor and city council of ——— do ordain as follows:

Sec. 1. Electric plant maintenance.—The company furnishing electrical energy for light, heat, and power in the city of ——— shall maintain its entire electric plant equipment and distribution system in such condition as will enable it to furnish, so far as practicable, safe, adequate, and continuous service within its hours of operation.

Sec. 2. Grounding of low-potential circuits.—The rules contained in the National Electrical Safety Code⁵² regarding grounding of low-potential circuits are hereby adopted as the standard for this city, and all new construction shall hereafter conform thereto.

Sec. 3. Testing facilities.—(a) The company shall provide for and have available such testing apparatus and equipment as may be necessary to comply with the terms of this ordinance. It shall have available standard portable watthour meters (rotating standards), indicating electrical instruments, and portable recording voltmeters, of types and capacities suitable for testing service watthour meters, and making voltage measurements on its distribution system.

⁵¹ A single ordinance for both gas and electric utilities may be desirable in the smaller cities having both utilities. (See B. S. Circulars 32 and 48.)

⁵² These rules are contained in B. S. Handbook No. 3, which may be obtained upon application to the Superintendent of Documents, Government Printing Office, Washington, D. C., at 40 cents per copy.

(b) The company shall provide for and have available suitable electrical measuring instruments and meters to be used as reference standards for testing and maintaining the accuracy of its portable testing meters and instruments.⁵³

Sec. 4. Deposits from customers.—The company may require from any customer whose credit has not been established to the satisfaction of the company a cash deposit of an amount equal to the estimated 45-day bill, and in any event not less than \$———. Interest thereon at the rate of —— per cent per annum, payable upon the return of the deposit, shall be paid by the company.

Sec. 5. Records.—(a) The company shall keep a record (1) of the names and addresses of all its customers and the company's serial number of the meter or meters used by each customer; (2) of all its meters, showing dates of installation and removal.

(b) The company shall keep a full and complete record of the results of all meter tests, showing the errors of meters as found and as left after test and adjustment, the reason for making the test, and the date when test was made. This record shall be kept for at least five years.

Sec. 6. Meter installation and testing.—(a) No watthour meter shall be placed in service or be allowed to remain in service which creeps or which has incorrect constants or is in any way mechanically defective. A meter creeps when with all load wires disconnected the moving element makes one complete rotation in five minutes or less.

(b) All watthour meters either before installation or within 60 days after being installed by the company on any customer's premises shall be tested for accuracy of adjustment and registration at approximately one-tenth and three-quarters of the rated capacity of the meter, commonly called light load and heavy load, respectively. All meters so tested and found in error in comparison with suitable standards shall be adjusted to register correctly to within plus 2 or minus 4 per cent at light load and to within plus or minus 2 per cent at heavy load.

(c) All watthour meters installed upon customers' premises shall be periodically tested by the company in accordance with the following schedule, and if found in error shall be adjusted to register correctly, as specified in (b) of this section.

1. Single-phase induction-type meters of rated capacity up to and including 25 amperes shall be tested at least once in every 48 months.

⁵³ See p. 274 for a more elaborate provision of an ordinance on this point.

2. Single-phase induction-type meters of rated capacity exceeding 25 amperes, and all polyphase, commutator, and mercury type meters, shall be tested at least once in every 24 months.

Sec. 7. Voltage variations and voltage records.—(a) The company shall adopt a standard nominal voltage for its constant-voltage lighting system, and should make every reasonable effort to maintain such voltage, as measured at the company's service terminals, so that variations of more than 5 per cent above or 5 per cent below such standard shall not occur between sunset and 11 o'clock p. m. (lighting hours), and the total variation of voltage from minimum to maximum shall not exceed 6 per cent of the nominal voltage. However, voltage variations caused by the operation of apparatus on the customer's premises necessarily requiring large starting currents, or in violation of the company's rules, or the action of the elements, shall not be considered a violation of this section.

(b) The company shall provide itself with one or more recording voltmeters of the type and capacity suited to its system. These recording instruments shall be kept continuously in use somewhere on the company's system.

Sec. 8. Meter testing on request of customer.—(a) The company shall upon the written request of any customer make, without charge, a test of the accuracy of his watthour meter, provided the customer does not make request for tests more frequently than once in 12 months. Such tests shall be made in the presence of the customer, if he desires it, with suitable testing instruments, and a written report giving the result of such test shall be made to the customer. The record of all such tests shall be kept on file in the office of the company for at least one year and be open to inspection upon demand by the customers affected.

(b) Tests shall be made with the meter in place of operation on the customer's premises and under local conditions of operation.

(c) If any test made upon a customer's complaint shows his meter, in comparison with suitable testing standards, to be in error to the prejudice of the customer in excess of 4 per cent, as averaged on light and heavy load,⁵⁴ the company shall refund to the complaining customer an amount equal to the excess charged for the kilowatthours incorrectly metered over a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months. After tests, meters shall be adjusted to register correctly to within the limits specified in section 6 (b) of this ordinance.

⁵⁴ See p. 282 for another method for finding the average error of a meter.

Sec. 9. Meter readings and bill forms.—(a) Bills rendered to customers periodically for electric service shall show the readings of the meter at the beginning and end of the interval for which the bill is rendered, the dates upon which the readings were taken, the total kilowatthours charged for, the net amount due, and all other essential facts upon which the bill is based.

(b) The company shall adopt some method of informing its customers as to the reading of meters, either by printing on bills a description of the method of reading meters, by distributing booklets or folders, or by a notice that the method will be explained at the office of the company upon request.

Sec. 10. Interruption of service.—The company shall keep a careful record of all interruptions of service upon its entire system or major portions thereof. Such record shall include the time, duration, and, as far as practicable, cause of each interruption, and shall be open to the inspection of customers affected.

Sec. 11. Complaints.—The company shall make an investigation of all reasonable complaints made to it by its customers, or by the city, and it shall keep a record of all such complaints, which record shall include the name and address of the complainant, the date, the character of the complaint, and the adjustment or disposition made thereof. This record shall be open to the inspection of customers affected.

Sec. 12. Penalties.—Upon violation of any section of this ordinance, or failure to comply with any provisions hereof, the company shall upon conviction be subject to and shall pay to the city a penalty of not less than ——— nor more than ——— for such offense; and each day's continuance of such violation or failure to comply shall be deemed a separate offense.

Sec. 13. Repeal.—All ordinances or parts thereof inconsistent with the terms of this ordinance are hereby repealed.

Sec. 14. Application of ordinance—Time of becoming effective.—

(a) This ordinance shall apply to any person, firm, or corporation now or hereafter engaged in the business of furnishing electrical energy in the city of ———. The word "company" shall be construed to refer to any such person, firm, or corporation.

(b) This ordinance shall take effect and be in force from and after ———.

NOTE.—The inclusion of the following sections may be desirable in many cities. Provision is made in these sections for a municipal officer to handle questions as between the city or individuals and the company.

Sec. 15. Inspector.—The city engineer⁵⁵ ex officio, shall, under the control and direction of the mayor, act as inspector of electric service and meters.

(a) He shall receive and make investigations of complaints regarding electric service and the accuracy of electric meters.

(b) He shall receive and file the reports made by the company.

(c) He shall perform any and all other duties naturally connected with his office as required or implied by any part of this ordinance, or as may be especially assigned to him at any time by the mayor and city council.

Sec. 16. Reports from the company.—The company shall make quarterly reports to the city inspector of meters of the results of all tests which it has made in accordance with the requirements of this ordinance. These reports shall be kept on file in the office of the inspector and shall be open to public inspection.

3. FOR THE LARGER CITIES.

AN ORDINANCE Providing for the appointment of an inspector of electric meters and service and defining the duties of such office; prescribing rules and regulations for standards of electric service; and otherwise regulating the service of electric companies supplying light, heat, and power.

Sec. 1. Definitions.—In this ordinance and the various sections and parts thereof the word “city” shall be construed to refer to the city of ———; the words “company” and “companies” to the company or companies authorized by law to generate, transmit, distribute, and sell electrical energy for light, heat, or power in said city of ———; the word “customer” shall include any person, company, corporation, or other party to whom said company or companies shall furnish electrical energy for use within said city; and the words “mayor,” “city clerk,” “city treasurer,” “inspector,” and “city council” shall be understood to refer to the mayor, the city clerk, the city treasurer, the inspector of electric meters and service, and the city council of said city of ———, respectively.

Sec. 2. Appointment of inspector.—(a) The mayor, subject to the approval of the city council, shall appoint as inspector of electric meters and service a suitable person who is qualified and recommended to the mayor and the city council, as follows: ——— and ——— and ——— shall constitute a board⁵⁶ for the

⁵⁵ City electrician or city sealer of weights and measures may be designated city inspector of meters and service.

⁵⁶ In many cities the existing civil-service commission would, of course, be the examining board. In case there is no civil-service commission, the city engineer, board of public works, superintendent of public schools, city electrician, or principal of high school may be designated as the examining board.

examination of all persons who shall apply for the position of inspector or deputy inspector. Said board shall give the public notice of the time and place of such examination at least one month before the same is to be held, and the notice shall be published in the official papers of the city at least twice each week during said month. At the time and place so fixed the board shall examine all applicants, in such a manner as it shall deem necessary to determine their technical knowledge and competency to perform all the duties of inspector or deputy inspector, as called for in this ordinance. Within one month after such examination said board shall certify to the mayor and the city council the names of such persons as said board shall deem fully competent to perform such duties. Only persons whose names are so certified shall be eligible to be appointed inspector or deputy inspector: *Provided, however,* That any person who shall previously have held the office of inspector under the provisions of this ordinance may be reappointed to said office without such certificate from the board: *Provided, also,* That a person who has once been certified as competent by said board shall be subsequently eligible for appointment without again being examined during a period of five years from such first examination.

(b) The inspector, his deputies, or his assistants, shall not be pecuniarily interested, either directly or indirectly, in the manufacture or sale of electrical energy, electric meters, or any article or commodity used by electric companies, or used for any purpose connected with the use of electrical energy. The inspector, his deputies, or his assistants, shall not give certificates or written opinions to a maker or vender of such articles or commodity.

(c) The inspector, appointed as hereinabove provided, shall take an oath of office such as is required of other city officials and he shall serve for a term of four years, or until his successor shall be properly appointed. He shall be eligible for reappointment without reexamination.

(d) The mayor may remove the inspector at any time for sufficient cause, but notice shall first be given to the incumbent of the charges against him, and he shall be given a period of 10 days in which to answer such charges. All such charges and the incumbent's defense against them shall be made a matter of public record: *Provided, however,* That at the time when first appointed, the appointee shall serve for a probationary period of six months; and he may be removed by the mayor during said

six months without the notice of charges against him, as is required above.

(e) The salary of said inspector shall be ——— per annum, payable monthly.

Sec. 3. Deputies and assistants.—(a) The inspector, with the consent and approval of the mayor, may appoint one or more deputy inspectors. Only those persons who shall have been examined by the board of examiners provided for in section 2, and who shall have been certified by said board as competent to become deputy inspectors, shall be eligible to be appointed as deputy inspectors. Said deputies so appointed shall have the power, under the direction of the inspector, to perform any duty which may be required of the inspector under the provision of this ordinance.

(b) The inspector, with the consent and approval of the mayor, may appoint one or more assistants or clerks (who need not necessarily be competent to make the tests herein provided for) who shall, under his direction, aid in the performance of the duties of this office.

(c) Each of said deputies and assistants shall take an oath of office such as is regularly required of other city officers.

(d) The salary of a deputy inspector shall be ——— per annum payable monthly.

Sec. 4. Duties of the inspector.—The inspector, in person or by deputy or properly qualified assistant, shall perform the following duties:

(a) He shall have full charge of all apparatus, laboratories, and offices provided for his work.

(b) He shall test and determine the adequacy and quality of the electric service furnished.

(c) He shall examine all rates and rate schedules for electric service and advise the mayor and council with reference to all such rates and rate schedules filed by the company in his office.

(d) He shall receive and investigate complaints from customers of the company regarding the voltage of the service furnished, the accuracy of meters, the efficiency of incandescent lamps furnished, and any other reasonable complaints made by customers.

(e) He shall test service meters upon the written application of any customers desiring such test.

(f) He shall test and certify all reference standards used by the company at least once a year.

(g) He shall keep a careful record of all complaints received and investigated, tests made, and instruments certified.

(h) He shall make regular monthly reports to the mayor or council and special reports when the adequacy and quality of service do not conform to the requirements of this ordinance.

(i) He shall perform any and all other duties naturally connected with his office as required or implied in this ordinance.

Sec. 5. Testing laboratory.—The city shall provide and maintain a testing laboratory, and shall equip it with such apparatus and facilities as may, in the judgment of the inspector, be necessary to carry out the provisions of this ordinance.⁵⁷

The inspector shall have custody and control of said laboratory and its equipment and maintenance. He shall have available at all times properly certified instruments for the measurement of electromotive force and current, and it shall be the duty of the inspector to have such instruments tested and certified periodically by the Bureau of Standards at Washington, or by some other standardizing laboratory of recognized standing.

Sec. 6. Maintenance of plant.—Each company shall maintain its entire plant and system in such condition as will enable it to furnish so far as practicable, safe, adequate, and continuous service within its hours of operation.

Sec. 7. Accepted practice.—The company's generating and distributing system, including (a) generating equipment; (b) transmission lines; (c) substations; (d) overhead system, poles, lines, transformers, etc.; (e) underground systems, manholes, conduits, etc.; (f) street-lighting system; (g) service wires and attachments; and (h) meters, etc., must be constructed, installed, and maintained in accordance with accepted good practice. It is expected that all possible care will be exercised by each company to reduce the life hazard (1) to which employees are subjected in working in generating stations and substations and on overhead and underground lines; (2) to which the company's customers may be subjected by the introduction of its wires into the residences of the customers; (3) and to which the general public may be subjected by the presence of overhead wires in the public streets and ways.

Sec. 8. Grounding of low-potential circuits.—The rules currently in force contained in the National Electrical Safety Code regarding grounding of low-potential circuits are hereby adopted. Each company shall adopt a plan whereby ungrounded circuits

⁵⁷ In case an adequate laboratory already exists in the city, this section should be so drawn as to take advantage of it, if proper arrangements can be made for such laboratory's cooperation with the city.

shall be grounded in conformity with the Safety Code rules and submit the said plan to the inspector for approval by ———, 192 —.

Sec. 9. Location of meters.—It is recommended that all meters hereafter installed on customers' premises should be located in the cellar or first floor, or as near as possible to the service, in a clean, dry, safe place, not subject to great variation in temperature, on a support free from vibration, and easily accessible for reading and testing. Unless unavoidable, meters should not be installed in attics, sitting rooms, bathrooms, bedrooms, show windows, or restaurant kitchens, over doors, over windows, or any location where the visits of the meter reader or tester will cause annoyance to the customer.

Sec. 10. Meter-testing equipment.—(a) *Working standards.*—The company shall provide for and have available portable "working" standards, such as indicating electrical testing instruments, portable watthour meters, and other apparatus and equipment necessary for testing customer's service meters in compliance with the requirements of this ordinance.

(b) *Check of working standards.*—The company shall provide for and have available as check or reference standards electrical indicating instruments and watthour meters, the accuracy of which shall be satisfactory to and certified by the inspector. All meters and instruments used for testing customer's service meters shall be checked against such reference standards at least weekly when regularly in use, and records kept of all checks made. Whenever any such check shows a meter or instrument not accompanied by a calibration card to be incorrect more than 1 per cent of full-scale value at any ordinarily used load, the meter or instrument shall be recalibrated.

Sec. 11. Place and method for meter testing.—(a) All tests on service meters provided for in this ordinance shall be made in the place of permanent location on the customer's premises with approved testing apparatus, and under local conditions, unless otherwise stated in any section of this ordinance.

(b) Meters installed with instrument transformers or shunts shall be tested jointly with such transformers or shunts, unless the ratio and phase angle of the transformers and the resistance of the shunts have been previously determined within 10 years and are on file at the office of the utility for use in calculating results of tests. Such tests must have been made by a laboratory of recognized standing or by the utility, using apparatus and methods satisfactory to the inspector.

(c) Meters that operate on loads of low power factor (lagging current) shall be tested and adjusted before installation to register correctly to within 2 per cent at a power factor of approximately 50 per cent and at approximately 100 per cent of rated current.

Sec. 12. Accuracy requirements for watthour meters.—(a) No watthour meter that has an incorrect register constant, test constant, gear ratio, or dial train, or which registers upon no load ("creeps"), shall be placed in service or be allowed to remain in service without adjustment and correction. A meter creeps when, with all load wires disconnected, the moving element makes one complete rotation in five minutes or less.

(b) No watthour meter that has an error in registration of more than plus 2 or minus 4 per cent at light load or plus or minus 2 per cent at heavy load shall be placed in service. Wherever on installation, periodic, or any other test a meter exceeds these limits it must be adjusted.

(c) Light load shall be approximately 5 to 10 per cent of the rated capacity of the meter. Heavy load shall be not less than 60 nor more than 100 per cent of the rated capacity of the meter.

Sec. 13. Installation tests.—All watthour meters shall be tested and adjusted by the company to register accurately to within the limits specified in section 12(b), before installation or within 60 days after installation. All direct-current meters shall be tested for accuracy within 60 days after installation.

Sec. 14. Periodic tests of watthour meters.—All watthour meters installed upon customer's premises shall be periodically tested by the company according to the following schedule:

Schedule for Periodic Testing of Watthour Meters.

	Rated capacity of meter in amperes or kilovolt-amperes.	To be tested at least once in every—
Direct-current meters.....	Exceeding 500 amperes.....	6 months.
	500 amperes to 50 amperes, inclusive.....	18 months.
	25 amperes and less.....	30 months.
Alternating-current meters:		
1. Single-phase.....	Exceeding 25 amperes.....	24 months.
	25 amperes and less.....	48 months.
2. Polyphase.....	Exceeding 50 kilovolt-amperes.....	12 months.
	50 kilovolt-amperes and less.....	24 months.

(b) Each company shall, as soon as possible after the adoption of this ordinance and with the approval and consent of the inspector, arrange to begin a schedule of meter testing as herein provided, testing meters installed longest first, and arrange such schedule so as to test all meters at least once in the periods above specified.

Sec. 15. Records and reports.—(a) Each company shall keep a complete record of all watthour meters installed on customers' premises. Such record shall include: An identifying number of the meter; type and capacity of meter; constants of the meter; date of each installation, removal, and test; the error at heavy load and at light load as found at each test; and the accuracy of adjustment as left after test.

The record of tests of each meter shall be continuous for at least two test periods and in no case for less than three years.

(b) The test records of each company shall be available for examination at any time by the inspector.

(c) A report shall be made by each company to the inspector at stated intervals, giving a summary of the tests. Blank forms will be furnished by the inspector on which reports are to be made.

(d) Each company shall report to the inspector before ——— the types and numbers of meters in its service, and yearly thereafter.

Sec. 16. Tests upon request of customer.—Each company shall, without charge, make a test of the accuracy of a meter upon request of a customer, provided such customer does not make a request for test more frequently than once in 12 months. A report giving results of such tests shall be made to the customer, and a complete record of such tests shall be kept on file at the office of the company.

Sec. 17. Tests by inspector.—Upon written application by any customer to the inspector a test shall be made of the customer's meter by the inspector, such test to be made as soon as practicable after receipt of the application. For such a test a fee of ——— shall be paid by the customer at the time application is made for the test, this fee to be retained if the meter is found to be slow or correct. If the meter is found to be more than 4 per cent fast the amount of the fee will be refunded to the customer and collected from the company owning the meter. The company owning the meter will be notified that such test is to be made and should have a representative present to open the meter, assist in the test and adjust and seal the meter after the test.

Sec. 18. Record of complaints.—Each company shall keep a record of written "complaints" received at its office in regard to service, which shall include the name and address of the customer, the date, nature of complaint, and the remedy. The record shall be available for inspection at any time within six months by the inspector.

Sec. 19. Information on bills.—Bills rendered periodically by the company shall show, in addition to the net amount due, the readings of the meter at the beginning and end of the time for which bill is rendered, the dates on which the readings were taken, and all the other essential facts upon which the bill is based.

Sec. 20. Information as to meter reading.—Each company shall adopt some method of informing its customers how meters are read, either by printing on bills a description of the method of reading meters or by a notice to the effect that the method will be explained on application.

Sec. 21. Incandescent lighting.—Each company shall render its customers reasonable assistance in securing incandescent lamps best adapted to the service furnished. Lamps furnished by the company without charge (free renewals) or at prices less than open-market prices, should be of such efficiency in lumens per watt, when used on the company's circuits of standard voltage as specified in section 23, that customers may obtain their lighting service under the most favorable conditions practicable under the rate schedule.

Sec. 22. Information as to kinds of service.—Each company shall furnish to any prospective customer, on request, a statement of the kind or kinds of service available, giving the standard voltage, nature of current, and if alternating current, the frequency and number of phases, and full schedule of rates. Where one class of service is available through only a part of the district served, this shall be stated in connection with any such request.

Sec. 23. Standard voltage and permissible voltage variations.—Each company shall adopt a standard nominal voltage or nominal voltages for its constant-voltage lighting system (or for each of the several districts into which the system may be divided) and shall maintain such voltage as measured at the company's service terminals, so that variations of more than 5 per cent above or 5 per cent below such standard voltage shall not occur between sunset and 11 p. m., and the total variation of voltage from minimum to maximum shall not exceed 6 per cent of the average voltage: *Provided, however,* That variations in voltage caused by the operation of apparatus on the customer's premises necessarily requiring large starting currents or in violation of the company's rules, or the action of the elements, shall not be considered a violation of this section.

Sec. 24. Voltage surveys.—Each company shall provide itself with one or more portable indicating voltmeters, and one or more

recording voltmeters, these instruments to be of a type and capacity suited to the voltage supplied. Each company shall make a sufficient number of voltage surveys to indicate the service furnished from each center of distribution to satisfy the inspector of its compliance with the voltage requirements, and shall keep at least one recording voltmeter in continuous service at the plant, office, or some customer's premises. Voltmeter records must be available to the inspector on demand.

Sec. 25. Station records and interruptions of service.—Each company shall keep a record of the time of starting and shutting down station apparatus, together with the indications of the principal switchboard instruments at frequent intervals, and shall maintain a record of all interruptions of service upon the entire system or major divisions of its system, and include in such record time, duration, and, as far as practicable, the cause of each interruption.

Sec. 26. File of rate schedules and rules.—Each company shall file copies of all schedules of rates and of all rules and regulations in the office of the inspector. A copy of all rate schedules, of all company rules and regulations, and of this ordinance furnished by the inspector, shall be on file in the office of the company and shall be open to public inspection.

Sec. 27. Refunds and prorated bills.—(a) Whenever a meter is found upon test, made by the company or the inspector, at the request of the customer, to be more than 4 per cent in error at any load, additional tests shall be made to determine the average error of the meter.

(b) *Average error.*—The average error of a meter in tests made by the inspector or company, at the request of the customer, shall be determined by one or the other of the following methods:

Method A:⁵⁸ Take one-fifth of the algebraic sum of (1) the error at light load; (2) three times the error at normal⁵⁹ load; (3) the error at full rated capacity.

Method B: Take one-half the algebraic sum of (1) the error at light load; (2) the error at heavy load.

⁵⁸ In determining normal load the following percentages of the several classes of full connected installations may be used:

	Per cent.
(a) Residence and apartment lighting.....	25
(b) Elevator service.....	40
(c) Factory lighting, individual drives, churches, offices, stables, and hotels.....	45
(d) Factory shaft drive, theaters, clubs, hallways, entrances, and general store lighting.....	60
(e) Saloons, restaurants, pumps, air compressors, and ice machines.....	70
(f) Sign and window lighting, blowers, moving-picture machines.....	100

⁵⁹ One or the other of these methods should be included in any ordinance adopted, not both.

(c) When a meter is found to have a positive average error—i. e., is fast—in excess of 4 per cent, in tests made at the request of the customer, the company shall refund to the customer an amount equal to the excess charged for the kilowatthours incorrectly metered, for a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months.

(d) When a meter is found to have a negative average error—that is, is slow—in excess of 4 per cent, in tests made at the request of the customer the company may make a charge to the customer for the kilowatthours incorrectly metered for a period equal to one-half of the time elapsed since the last previous test, but not to exceed six months. If a meter is found not to register for any period, the company shall estimate and charge for the kilowatthours used by averaging the amounts registered over similar periods, preceding or subsequent thereto, or over corresponding periods in previous years.

Sec. 28. Deposits.—Each company may require from any customer or prospective customer a deposit of an amount equal to the estimated 45-day bill, and in any event not less than ———. Interest thereon at the rate of — per cent per annum, payable upon the return of the deposit,^a shall be paid by the utility to each customer making such deposit, for the time such deposit was held by the company and the customer was served.

Each company shall issue to every customer from whom a deposit is received a certificate of deposit, and shall provide reasonable ways and means whereby a depositor who makes application for the return of his deposit, or any balance to which he is entitled, but is unable to produce the original certificate of deposit, may not be deprived of his deposit or balance.

Sec. 29. Repeal.—All ordinances and parts thereof contravening or inconsistent with the terms of this ordinance are hereby repealed.

Sec. 30. Time of becoming effective.—This ordinance shall take effect and be in force from and after ———.

^a Many public-service commission rules add here "or annually upon request of the customer."

APPENDIXES.

APPENDIX 1.

SECTIONS FROM STATE LAWS PROVIDING FOR THE REGULATION OF ELECTRIC SERVICE.

Sections from the laws of the various States on the general subject of the regulation of electric service are here collected for ready reference. As far as possible all legislation to date (1923) has been included in this summary.

It is believed that all the most important provisions of State laws are included, though there are no doubt certain sections omitted from the laws given that may have a general bearing on the question of electric service.

In most States the regulation of gas and electric service is provided for in the same section of the law, though this is not true in all cases. This difference explains the mention of gas service in some laws and not in others, as here quoted. Sections dealing exclusively with gas service are omitted.

To facilitate further reference a list of statutes is given below alphabetically, by States.⁶⁰

The following States at this time (1923) apparently have no laws on electric service, as discussed in this circular or in the National Electrical Safety Code: Delaware, Florida, Kentucky, Minnesota, Mississippi, New Mexico, South Dakota, and Texas.

1. List of Statutes Covering Adequacy and Safety of Electric Service.

ALABAMA.

An act to change the name of the Railroad Commission of Alabama to the Alabama Public Service Commission and to enlarge its authority, powers, and jurisdiction. Approved September 25, 1915.

ARIZONA.

Session Laws, 1912, chapter 90. An act relating to public-service corporations, providing for the regulation of the same, fixing penalties for the violation thereof, and repealing certain acts, with an emergency clause. Approved May 28, 1912.

Session Laws, 1912, special session, chapter 52. An act providing for the sale of water, gas, and electricity by meter measurement; for inspection of water, gas, and electric meters * * *. Approved June 19, 1912.

⁶⁰ For complete compilations of the public-utility laws of the States, reference should be made to the following: (1) Proceedings of the Twenty-third Annual Convention of the National Association of Railway Commissioners; Compilation of the Laws of the States Pertaining to Railways and other Public-Service Corporations; Traffic Service Bureau, Chicago, 1912. (2) Commission Regulation of Public Utilities; A Compilation and Analysis of Laws of Forty-three States and of the Federal Government for the Regulation by Central Commissions of Railroads and other Public Utilities; The National Civic Federation, New York, 1913. No compilation of laws enacted since 1913 seems to have been made.

ARKANSAS.

Act No. 571. General Assembly of 1919. An act to create the Arkansas Corporation Commission and to define its duties and powers. Approved April 1, 1919.

Act No. 124. General Assembly of 1921. An act to amend Act No. 571 of the general acts of the general assembly of the State of Arkansas for the year 1919 * * * and to regulate public utilities and public-service corporations and for other purposes. Approved February 15, 1921.

CALIFORNIA.

Statutes of 1915, chapter 600. An act regulating the placing, erection, use, and maintenance of electric poles, wires, cables, and appliances, and providing the punishment for the violation thereof. Approved June 1, 1915.

Laws of 1917, chapter 575. An act to amend "An act to regulate, etc." (of 1911, of which the statute above is also an amendment). Approved May 22, 1917.

Public Utilities Act, chapter 91. An act to provide for the organization of the railroad commission. * * * Approved April 23, 1915. In effect August 8, 1915.

COLORADO.

Session Laws, 1913, chapter 127. An act concerning public utilities, creating a public-utilities commission, prescribing its powers and duties. * * * Approved April 12, 1913. Effective August 15, 1914.

CONNECTICUT.

Public Acts, 1911, chapter 128. An act concerning the regulation and supervision of public-service corporations. Approved July 11, 1911.

DISTRICT OF COLUMBIA.

Public—No. 435, H. R. 28499. An act making appropriations for the expense of the government of the District of Columbia for the fiscal year ending June 30, 1914, and for other purposes. Approved March 4, 1913.

GEORGIA.

Code, 1911. An act to increase the membership of the Railroad Commission of Georgia. Approved August 22, 1907.

House Bill No. 260. An act to change the name of the Railroad Commission of Georgia to the Georgia Public Service Commission, etc., August 21, 1922.

IDAHO.

House Bill No. 21, session laws, 1913. An act to provide for the organization of the public utilities commission. * * * Approved March 13, 1913.

IOWA.

1913 Code, sections 2120*n* to 2120*r*, supplement to the 1913 Code, and section 1527*c*, supplement to the 1913 Code, as amended by the Thirty-ninth General Assembly.

ILLINOIS.

An act concerning public utilities. Approved June 29, 1921. Effective July 1, 1921.

INDIANA.

Acts of 1913, sixty-eighth session, chapter 76. An act concerning public utilities, creating a public service commission. Approved March 4, 1913. In effect May 1, 1913.

KANSAS.

Laws, 1911, chapter 238. An act relating to public utilities and common carriers, being an act creating the public utilities commission. * * *

Special Session Laws of 1920. An act creating the Court of Industrial Relations * * *, abolishing the Public Utilities Commission. * * * Amended 1921. Senate Bill 218.

Chapter 260, Senate Bill No. 217. An act establishing and relating to a public utilities commission, 1921.

LOUISIANA.

Constitution of 1921. Article VI creates the Louisiana Public Service Commission and defines its powers and duties.

MAINE.

Seventy-sixth legislature, Senate No. 453, chapter 129. An act to create a public utilities commission, prescribe its powers and duties, and provide for the regulation and control of public utilities. Effective September, 1914.

MARYLAND.

Laws, 1910, chapter 180, public-service commission law. An act to create and establish a public-service commission and prescribing its powers and duties. * * * Approved April 5, 1910. Amendments, 1912 and 1914.

MASSACHUSETTS.

Acts of 1914, chapter 742. An act to consolidate the laws relating to the manufacture, distribution, and sale of gas and electricity. Approved July 3, 1914.

General Acts, 1919, chapter 350. An act to organize in departments the executive and administrative functions of the Commonwealth. Approved July 23, 1919. (This act abolishes Board of Gas and Electric Light Commissioners, and creates a department of public utilities.)

MICHIGAN.

Public Acts, 1921, No. 271. Approved May 18, 1921, and amending an act to regulate the transmission of electricity. * * * Approved May 19, 1909.

Legislature of 1919, regular session. Senate enrolled Act No. 180. An act to provide for the regulation and control of certain public utilities operated within this State; to create a public utilities commission and to define the powers and duties thereof. * * *

MISSOURI.

Laws, 1913. Public-service commission law. Approved March 17, 1913. In effect April 15, 1913.

MONTANA.

Session Laws, 1913, chapter 52, public-service commission law. An act making the board of railroad commissioners of the State of Montana ex officio a public-service commission. * * * Approved March 4, 1913.

NEBRASKA.

Chapter 242, Session Laws of 1915 as amended in 1917. An act to regulate the construction, operation, and maintenance of electric transmission, telephone, and telegraph lines in the State of Nebraska. * * * Approved April 12, 1917.

NEVADA.

Statutes 1919, chapter 109. An act defining public utilities, providing for the regulation thereof, creating a public-service commission, defining its duties and powers, and other matters relating thereto. Approved March 28, 1919.

NEW HAMPSHIRE.

Public Acts, 1911, chapter 164. An act to establish a public-service commission. Approved April 15, 1911. In effect May 15, 1919.

Public Acts, 1913, chapter 124. An act providing for the inspection of the service equipment of public utilities by the Public Service Commission. Approved May 7, 1913.

NEW JERSEY.

Laws, 1911, chapter 195. An act concerning public utilities, to create a board of public-utility commissioners and to prescribe its duties and powers. Approved April 21, 1911. In effect May 1, 1911.

NEW YORK.

Acts of 1910, chapter 480. An act in relation to public-service commissions. Became a law June 14, 1910. Chapter 429, laws of 1907, * * * is amended by the above, and as amended is the public-service commissions law.

Laws of New York, 1921, chapter 134. An act to amend the public-service commissions law, in relation to creating the public-service commission and the transit commission, defining the jurisdiction, powers, and duties of such commissions, and abolishing the public-service commission of the first district, the public-service commission of the second district, and the office of the transit construction commissioner. Became a law March 30, 1921.

Laws of New York, 1921, chapter 335. An act to amend the public-service commission law generally. Became a law April 27, 1921.

NORTH CAROLINA.

Public Laws, session 1913, chapter 127. An act to regulate electric light, power, water, and gas companies. Ratified March 11, 1913.

NORTH DAKOTA.

Sixteenth Session, Legislative Assembly, House Bill 97. Approved March 5, 1919. Chapter 192. Regulation of public utilities by the Board of Railroad Commissioners.

OHIO.

Laws of Ohio relating to the Public Utilities Commission, 1913. In effect August 9, 1913.

Sections 8975 and 8976 of the General Code as amended June 7, 1921.

OKLAHOMA.

House Bill No. 156. An act to extend the jurisdiction of the corporation commission over the rates, charges, services, and practices of water, heat, light, and power companies, and to give said commission general supervision over such utilities, and declaring an emergency. Approved March 25, 1913.

OREGON.

Laws of 1911, chapter 279. Public-utility act of the State of Oregon. Act effective by vote of people November 5, 1912.

Laws of 1919, chapter 163. An act to prescribe the manner of installation of wires and equipment to convey electric current, etc. * * * Approved February 26, 1919.

PENNSYLVANIA.

Act of July 26, 1913, No. 854. An act defining public-service companies, and providing for their regulation, etc. * * * Approved July 26, 1913. In effect January 1, 1914.

RHODE ISLAND.

Public Laws, 1912, chapter 795. An act to create and establish a public utilities commission and prescribe its powers and duties, and to provide for the regulation and control of public utilities. Approved April 17, 1912.

SOUTH CAROLINA.

Acts of 1910, No. 286. An act to establish a public-service commission, to fix and establish in all cities of the State charges for the supply of water, gas, or electricity furnished by any person, firm, or corporation, to such city and the inhabitants thereof and to prescribe penalties. Approved February 23, 1910.

An act to establish the railroad commission of this State; to consolidate the offices of the railroad commission and the public-service commission as the same now exist, and devolve the powers and duties thereof upon the railroad commission hereby established; * * * and to safeguard the interests of the people of the State in relation to all transporting and transmitting corporations and public utilities operating in this state. Approved March 6, 1922.

TENNESSEE.

Public Acts, 1919, chapter 49, Senate Bill No. 314. A bill to be entitled an act to amend an act entitled "An act to create a railroad commission in this State and define its duties and powers * * *" to change the name of the railroad commission, to increase its powers and functions, and to embrace within its jurisdiction and powers all other public utilities. Approved February 21, 1919.

Public Acts, 1921, chapter 171, Senate Bill No. 1072. A bill to be entitled an act to protect railroads and their employees from the danger incident to the stringing of wires by wire-using companies over railroad tracks * * *. Approved April 9, 1921.

UTAH.

Laws of Utah 1917, chapter 47. An act creating a public utilities commission, prescribing the powers and duties of the commission and the duties of public utilities. * * * Approved March 8, 1917.

VERMONT.

Acts of 1908, No. 116. An act changing the name of the Board of Railroad Commissioners to Public Service Commission and providing for the supervision of gas plants, electric light plants, telegraph and telephone lines, and express companies. Approved January 20, 1909. In effect April 1, 1909.

VIRGINIA.

Chapter 340. An act imposing public duties on heat, light, power, water, and telephone companies, and providing for the control and regulation of such companies by the State Corporation Commission. Approved March 27, 1914.

WASHINGTON.

Laws of 1911, chapter 117. An act relating to public-service properties and utilities, providing for the regulation of the same, fixing penalties for the violation thereof, making an appropriation, and repealing certain acts. Approved March 18, 1911. In force June 8, 1911.

Laws of 1921, chapter 7. An act relating to and to promote efficiency, order, and economy in the administration of the government of the State, prescribing the powers and duties of certain offices and departments, defining offenses and fixing penalties, abolishing certain offices, and repealing conflicting acts and parts of acts. Approved February 9, 1921.

WEST VIRGINIA.

Acts of 1913. An act to create a public-service commission and to prescribe its powers and duties, and to prescribe penalties for the violation of the provisions of this act. In effect May 21, 1913.

Acts of 1915. An act to amend and reenact sections * * * of chapter 9 of acts of 1913 creating a public-service commission, etc. In effect May 10, 1915.

Acts of 1921, chapter 150. In effect April 29, 1921.

WISCONSIN.

Laws of 1907, chapter 499. Public-utilities law of Wisconsin, section 1797m-1 to 1797m-109 (amendments in 1911).

WYOMING.

Chapter 146, Senate file No. 5, the public-utilities act. An act regulating public utilities, creating and establishing a public-service commission. * * * Approved March 4, 1915.

2. Sections of State Laws Relating to Electric Service.

ALABAMA.

SEC. 4. That the Alabama Public Service Commission shall have general supervision of all persons, firms, corporations, operating public utilities, mentioned in this act, shall inquire into the management of the business, and shall keep itself informed as to the manner and method in which the business is conducted. It shall examine such public utilities as often as may be necessary to keep informed as to their general condition, their franchises, capitalization, rates and other charges, and in the manner in which their plants, equipments, and other property are owned, leased, controlled, managed, conducted, and operated, not only with respect to adequacy, security, and accommodation afforded by their service, but also with respect to their compliance with the provisions of this act and any other law or laws, with the orders of the commission and with the charter and franchise requirements. It shall assemble and keep on file available for the use of the public, full statistics on the foregoing, as well as all other matters or things connected with such utility as is necessary to a full knowledge of their business and affairs. (Act of September 25, 1915.)

ARKANSAS.

SEC. 3. That section 5 of the said Act No. 571, General Acts of the General Assembly of the State of Arkansas of 1919, above more particularly referred to, be and the same is hereby amended to read as follows: Section 5:

Jurisdiction.—The jurisdiction of the Commission shall extend to and include all matters pertaining to the regulation and operation of,

(a) All

Gas companies,

Electric lighting companies, and other companies furnishing gas or electricity for light, heat, or power purposes.

Hydroelectric companies for the generation and for transmission of light, heat, or power.

Water companies, furnishing water within municipalities for municipal, domestic, or industrial use.

Provided, however, That nothing herein shall vest said commission with jurisdiction as to any rate, charge, rule, regulation, order, hearing, investigation, or other matter pertaining to the operation within the limits of any municipality of any street railroad, telephone company, gas company, pipe line company for transportation of oil, gas or water, electrical company, water company, hydroelectric company, or other company operating a public utility or furnishing public service as to which jurisdiction

may be elsewhere conferred in this act upon any municipal council or city commission; not withstanding, however, the jurisdiction of the municipality as to the above matters within the limits of such municipality the said Arkansas Railroad Commission shall have and is hereby delegated the authority and duty to require all utility companies now furnishing public service within the limits of any municipality to furnish and continue furnishing such service to such municipality though the right of regulation of such utility as to rates and all other matters within such municipality is herein elsewhere conferred upon the municipal councils or city commissions subject to right of appeal to the courts.

Provided further, That nothing herein shall vest said commission with jurisdiction as to any improvement district or municipality furnishing gas or electricity for any purpose.

And for the purpose of this act, and in the construction of this act, every person, firm, association, company, partnership or corporation, or other organizations engaged in the operation of any public utility above indicated, shall be deemed to be a company within the meaning of this act.

All other jurisdictions, if any, possessed by the Arkansas Railroad Commission under the laws of Arkansas, in force on March 31, 1919.

SEC. 17. The jurisdiction of the municipal council or city commission of any municipality shall extend to and include all matters pertaining to the regulation and operation within the limits of any such municipality of any street railroad, telephone company, gas company furnishing gas for domestic or industrial purposes, pipe line company for transportation, distribution, or sale of oil, gas, or water, electrical company, water company, hydroelectric company, or other company, operating a public utility or furnishing public service within such municipality.

Every person, firm, company, or corporation engaged in any such public service business within any municipality shall establish, make, and maintain such adequate and suitable facilities, appliances, devices, connections, installations, and improvements in said municipality as may be essential to enable such public utility to properly perform its public utility duties within said municipality, so far as may be required by its franchise or contract, or so far as it is within the police power of this State or said municipality to repair such service, and the municipal councils or city commissions of municipalities within the State of Arkansas, regardless of class, shall have the exclusive right, and it is hereby made their duty from time to time to make all reasonable and proper rules and regulations with reference to the operation within such municipality of any such utility and to order the performance of any duty devolving on such public utility under its franchise or contract, if any, or under this or any other statute or law * * *. Act No. 124. Approved February 15, 1921.

ARIZONA.

SEC. 13. (b) Every public service corporation shall furnish, provide, and maintain such service, instrumentalities, equipment, and facilities as shall promote the safety, health, comfort, and convenience of its patrons, employees, and the public, and as shall be in all respects adequate, efficient, just and reasonable.

(c) All rules and regulations made by a public-service corporation affecting or pertaining to its charges or service to the public shall be just and reasonable.

SEC. 35. Whenever the commission, after a hearing had upon its own motion or upon complaint, shall find that the rules, regulations, practices, equipment, appliances, facilities, or service of any public-service corporation, or the methods of manufacture distribution; transmission, storage, or supply employed by it, are unjust, unreasonable, unsafe, improper, inadequate, or insufficient, the commission shall determine the just, reasonable, safe, proper, adequate, or sufficient rules, regulations, practices, equipment, appliances, facilities, service, or methods to be observed, furnished, constructed,

enforced, or employed, and shall fix the same by its order, rule, or regulation. The commission shall prescribe rules and regulations for the performance of any service or the furnishing of any commodity of the character furnished or supplied by any public-service corporation, and upon proper demand and tender of rates such public-service corporation shall furnish such commodity or render such service within the time and upon the conditions provided in such rules.

SEC. 46. (a) The commission shall have power, after hearing had upon its own motion or upon complaint, to ascertain and fix just and reasonable standards, classifications, regulations, practices, measurements, or service to be furnished, imposed, observed, and followed by all electrical, gas, and water corporations; to ascertain and fix adequate and serviceable standards for the measurement of quantity, quality, pressure, initial voltage, or other conditions pertaining to the supply of the product, commodity, or service furnished or rendered by any such public-service corporation, to prescribe reasonable regulations for the examination and testing of such produce, commodity, or service and for the measurement thereof; to establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for measurements; and to provide for the examination and testing of any and all appliances used for the measurement of any product, commodity, or service of any such public-service corporation.

(b) The commissions and their officers and employees shall have power to enter upon any premises occupied by any public-service corporation for the purpose of making the examinations and tests and exercising any of the other powers provided for in this act, and to set up and use on such premises any apparatus and appliances necessary therefor. The agents and employees of such public-service corporation shall have the right to be present at making of such examinations and tests.

(c) Any consumer or user of any product, commodity, or service of a public-service corporation may have any appliance used in the measurements thereof tested upon paying the fees fixed by the commission. The commission shall establish and fix reasonable fees to be paid for testing such appliances on the request of the consumer or user, the fee to be paid by the consumer or user at the time of his request, but to be paid by the public-service corporation and repaid to the consumer or user if the appliance is found defective or incorrect to the disadvantage of the consumer or user under such rules and regulations as may be prescribed by the commission. (Session Laws, 1912, chap. 90, regular session.)

SEC. 2. It shall be the duty of the State inspector of weights and measures in unincorporated or incorporated cities or towns with a population of not more than 5,000 nor less than 1,000 inhabitants, according to the latest official State or United States census, at least once in every two years, and as much oftener as he may deem necessary, to test the accuracy of every meter used or to be used in the measuring of any water, electricity, or gas furnished or to be furnished to the customer through such meter. If the meter tested shall upon test thereof by the inspector be found to measure too fast or too slow by as much as 3 per cent, such meter shall be condemned by him and shall not be again used, or used at all until corrected and made to measure accurately. Unless any water, gas, or electric meter is made to conform with the standard of such State inspector within 30 days after the date of the condemnation by such inspector, the said State inspector is not required to retest such condemned water, gas, or electric meter for a period of one year thereafter.

The State inspector shall keep in a book, together with a card-index system to be furnished him by the State, a complete list of meters inspected and tested by him, the name of the person, firm, or corporation owning the same, the name of the furnisher of the water, gas, or electricity, the name of the consumer thereof, and the date and result of all inspections, and shall at all times keep the same open to the inspection of the public.

SEC. 3. He shall, upon the written request of any citizen, firm, or corporation, or educational institution in the State, test any water, gas, or electric meters used as standards in the State. He shall at least once every year test all water, gas, and electric meters used in any institution for the maintenance of which moneys are appropriated by the legislature, and he shall report in writing his findings to the supervisory board and to the executive officers of the institution concerned.

SEC. 4. It shall be the duty of the city sealer⁶¹ in unincorporated or incorporated cities of not less than 5,000 population, according to the latest official State or United States census, at least once every two years, and as much oftener as may in his judgment be necessary, or whenever requested in writing by either the furnisher of water, electricity, or gas, or by the consumer of the same, to test the accuracy of any meter used or to be used in the measuring of any water, electricity, or gas furnished or to be furnished to the consumer through such meter. If the meter tested shall upon test thereof by the sealer be found to measure too fast or too slow by as much as 3 per cent, such meter shall be condemned by him, and the owner or owners of the same shall be notified of the condemnation at the time when such condemnation is made by the city sealer, and such meter shall not be again used or used at all until corrected and made to measure accurately.

The city sealer shall keep in a book, together with a card-index system to be furnished him by the city, a complete list of all meters inspected and tested by him, the name of the person, firm, or corporation owning the same, the name of the furnisher of the water, gas, or electricity, the name of the consumer thereof, and the date and result of all inspections, and shall at all times keep the same open to the inspection of the public.

SEC. 5. Where water, electrical energy, or illuminating gas is or shall hereafter be sold for the purpose of lighting, heating, or other domestic uses in the State of Arizona, the same shall be furnished, sold, delivered, charged, and paid for by meter measurement, if the consumer shall so request of the furnisher; and the meter to be used in measuring the same shall be of standard make, and may be furnished and installed in position for use by either the furnisher of the water, electricity, or gas, or by the consumer of the same.

SEC. 6. It shall be unlawful for any person, firm, or corporation in any city having a city sealer of weights and measures to install any water, electric, or gas meter for measuring water, electricity, or gas for purposes of lighting, heating, or other commercial or domestic uses without first having had such meter tested by the city sealer of weights and measures.

SEC. 7. It shall be unlawful for any person, firm, or corporation to sell and deliver, charge and collect for, or pay for water, electrical energy, or illuminating gas used or to be used for lighting, heating, or other commercial or domestic purposes, except by meter measurement, if the consumer shall request that the same be sold by meter measurement, or to charge and collect for or pay for a greater amount of such water, electrical energy, or illuminating gas than actually furnished during the period for which the charge was made: *Provided, however,* That an allowance of not exceeding 3 per cent may be made for inaccuracy in meter measurement.

SEC. 8. It shall be unlawful for any person, firm, or corporation to use any water, electric, or gas meter which shall have been tested and condemned by the State inspector or city sealer of weights and measures for the purpose of measuring water, electricity, or gas without first having had the same corrected and made to record the measurement of the same accurately.

⁶¹ "All such weights and measures and other testing apparatus having been tried and accurately proved by him shall be sealed and certified to by the State inspector, as hereinbefore provided, and shall then be deposited with and preserved by the city sealer as the public standards for such city." (Sec. 4, chap. 91 Session Laws, 1912, regular session.)

SEC. 9. In cities having a sealer of weights and measures where water, illuminating gas, or electrical energy is or shall hereafter be sold, every person, firm, or corporation furnishing such water, gas, or electricity shall file at the office of the city sealer a complete written list of the readings of all water, gas, or electric meters, together with the individual meter numbers and the address of the premises upon which such meter is located upon the day such readings are made.

SEC. 10. The fee for making the test of any water, gas, or electric meter shall be the sum of \$1, and shall in all cases be advanced and paid by the party demanding the test, but in case the meter be one already in use and be found to be measuring too fast by as much as 3 per cent the inspector or sealer shall return the fee to the consumer if same was advanced by him, and the same shall be and become a lawful charge against the furnisher, and the inspector or sealer shall collect the fee from the said furnisher of water, gas, or electricity.

SEC. 11. Any person, firm, or corporation, or any agent or employee thereof, violating any of the provisions of this act shall, upon conviction thereof, be punished by a fine of not less than \$10 nor more than \$250, or by imprisonment in the county jail for not less than one day nor more than 90 days, or by both such fine and imprisonment.

SEC. 12. The continuance of such violation from day to day shall be deemed a separate offense as to each day on which such violation is continued.

SEC. 13. Each State inspector and city sealer of weights and measures shall be under the direction and control of the corporation commission in all functions connected with the inspection of water, gas, and electric meters, as herein provided.

SEC. 14. All acts and parts of acts in conflict with this act are hereby repealed. (Session Laws, 1912, chap. 52, special session.)

CALIFORNIA.

SEC. 13. (b) Every public utility shall furnish, provide, and maintain such service, instrumentalities, equipment, and facilities as shall promote the safety, health, comfort, and convenience of its patrons, employees, and the public, and as shall be in all respects adequate, efficient, just, and reasonable.

(c) All rules and regulations made by a public utility affecting or pertaining to its charges or service to the public shall be just and reasonable.

SEC. 35. Whenever the commission, after a hearing had upon its own motion or upon complaint, shall find that the rules, regulations, practices, equipment, appliances, facilities, or service of any public utility, or the methods of manufacture, distribution, transmission, storage, or supply employed by it, are unjust, unreasonable, unsafe, improper, inadequate, or insufficient, the commission shall determine the just, reasonable, safe, proper, adequate, or sufficient rules, regulations, practices, equipment, appliances, facilities, service, or methods to be observed, furnished, constructed, enforced, or employed, and shall fix the same by its order, rule, or regulation. The commission shall prescribe rules and regulations for the performance of any service or the furnishing of any commodity of the character furnished or supplied by any public utility, and upon proper demand and tender of rates such public utility shall furnish such commodity or render such service within the time and upon the conditions provided in such rules.

SEC. 46. (a) The commission shall have power, after hearing had upon its own motion or upon complaint, to ascertain and fix just and reasonable standards, classifications, regulations, practices, measurements, or service to be furnished, imposed, observed, and followed by all electrical, gas, and water corporations; to ascertain and fix adequate and serviceable standards for the measurement of quantity, quality, pressure, initial voltage, or other conditions pertaining to the supply of the product, commodity, or service furnished or rendered by any such public utility, to prescribe reasonable regulations for the examination and testing of such produce, commodity, or service and for the measurement thereof; to establish reasonable rules, regulations,

specifications, and standards to secure the accuracy of all meters and appliances for measurements; and to provide for the examination and testing of any and all appliances used for the measurement of any product, commodity, or service of any such public utility.

(b) The commissions and their officers and employees shall have power to enter upon any premises occupied by any public utility for the purpose of making the examinations and tests and exercising any of the other powers provided for in this act, and to set up and use on such premises any apparatus and appliances necessary therefor. The agents and employees of such public utility shall have the right to be present at making of such examinations and tests.

(c) Any consumer or user of any product, commodity, or service of a public utility may have any appliance used in the measurement thereof tested upon paying the fees fixed by the commission. The commission shall establish and fix reasonable fees to be paid for testing such appliances on the request of the consumer or user, the fee to be paid by the consumer or user at the time of his request, but to be paid by the public utility and repaid to the consumer or user if the appliance is found defective or incorrect to the disadvantage of the consumer or user under such rules and regulations as may be prescribed by the commission. (Public utilities act, chapter 91, effective August 8, 1915.)

COLORADO.

SEC. 13. (b) Every public utility shall furnish, provide, and maintain such service, instrumentalities, equipment, and facilities as shall promote the health, safety, comfort, and convenience of its patrons, employees, and the public, and as shall in all respects be adequate, efficient, just, and reasonable.

SEC. 31. (a) The commission shall have power, after hearing had upon its own motion or upon complaint to ascertain and fix just, and reasonable standard, classifications, regulations, practices, measurements or service to be furnished, imposed, observed, and followed by all electrical, gas, and water public utilities; to ascertain and fix adequate and serviceable standards for the measurement of quantity, quality, pressure, initial voltage, or other conditions pertaining to the supply of the product, commodity, or service furnished or rendered by any such public utility; to prescribe reasonable regulations for the examination and testing of such product, commodity, or service and for the measurement thereof; to establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for measurement and weighing; and to provide for the examination and testing of any and all appliances used for the measurement or weighing of any product, commodity, or service of any such public utility.

(c) Any consumer or user of any product, commodity, or service of a public utility may have any appliances used in its measurement thereof tested upon paying the fees fixed by the commission. The commission shall establish and fix reasonable fees to be paid for testing such appliances on the request of the consumer, the fee to be paid by the consumer or user at the time of his request, but to be paid by the public utility and repaid to the consumer or user if the appliance is found defective or incorrect to the disadvantage of the consumer or user, under such rules and regulations as may be prescribed by the commission.

CONNECTICUT.

SEC. 19. *Powers of commission concerning electricity and gas.*—The office of inspector general of gas meters and illuminating gas is hereby abolished, and the duties heretofore invested in said offices shall hereafter be performed by the commission. The commission shall also have power to fix the standard of illuminating and heating, power, purity and quality of gas, to fix the initial efficiency of electric lamps furnished by electric companies, and to investigate and make orders regarding the pressure at which gas, and the voltage at which electricity, shall be distributed.

SEC. 20. *Inspection of meters.*—Upon petition of any person and the payment by such person of a fee of \$1 for each meter, the commission shall cause to be inspected any electric, gas, or water meter used in measuring electricity, gas, or water supplied to such petitioner. The company supplying electricity, gas, or water through such meter shall reimburse the petitioner for said fee if such meter be found to be more than 2 per cent fast in the case of a gas meter, or 4 per cent fast in the case of an electric or water meter, and shall not again use such meter until corrected and approved by the commission. The commission shall cause to be approved every electric, gas, or water meter in which the error does not exceed 2 per cent for gas meters or 4 per cent for electric or water meters, and shall cause the same to be stamped with some suitable device and the date of approval. (Public Acts, 1911, chap. 128.)

DELAWARE.

SEC. 4. The board shall have general supervision over all public utilities as herein defined, within the limits of the city of Wilmington, and shall have power, after hearing upon notice, by order in writing:

(a) To require every such public utility as herein defined to comply with the laws of the State relating thereto, or with any legally adopted ordinance or regulation of the said city of Wilmington, or with any of the terms of the franchise under which such public utility operates.

(b) To require every such public utility as herein defined to furnish safe and adequate service. (Laws 1911, vol. 26, chap. 206.)

DISTRICT OF COLUMBIA.

SEC. 8, PAR. 21. That the commission shall ascertain and fix adequate and serviceable standards for the measurement of quality, pressure, initial voltage, or other condition pertaining to the supply of the product or service rendered by any public utility and prescribe reasonable regulations for examining and testing such product or service and for the measurement thereof. It shall establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for measurement and every public utility is required to carry into effect all orders issued by this commission relative thereto.

PAR. 22. That this commission shall provide for the examination and testing of any and all appliances used for the measuring of any product or service of a public utility. Any consumer or user may have any such appliance tested upon payment of the fees fixed by the commission. The commission shall declare and establish reasonable fees to be paid for testing such appliances on the request of the consumer or users, the fee to be paid by the consumer or user at the time of his request, but to be paid by the public utility and repaid to the consumer or user if the appliance be found defective or incorrect to the disadvantage of the consumer or user.

PAR. 23. That the commission may purchase such materials, apparatus, and standard measuring instruments for such examination and tests as it may deem necessary. The commission, its agents, experts, or examiners shall have power to enter upon any premises, occupied by any public utility for the purpose of making the examination and tests provided for in this section, and to set up and use on such premises any apparatus and appliances and occupy reasonable space therefor.

PAR. 55. That the commission shall, within its jurisdiction, * * * examine or investigate the methods employed by such persons and corporations in manufacturing, distributing, and supplying gas or electricity for light, heat, or power, and in transmitting the same, and have power to order such reasonable improvements as will reasonably promote the public interest, preserve the public health, and protect those using such gas or electricity and those employed in the manufacture and distribution thereof or in the manufacture and operation of the works, wires, poles, lines, conduits, ducts, and systems connected therewith, and have power to order

reasonable improvements and extensions of the works, wires, poles, lines, conduits, ducts, and other reasonable devices, apparatus, and property of gas corporations and electrical corporations.

Have power * * * to prescribe from time to time the efficiency of the electric supply system, of the current supplied, and of the lamps furnished by the persons or corporations generating and selling electric current, * * * and for the purpose of determining whether the efficiency of the electric supply system of the current supplied and of the lamps furnished conform to the orders issued by the commission. The commission shall have power of its own motion to examine and investigate the plants and methods employed in manufacturing, delivering, and supplying gas or electricity, and shall have access through its members or persons employed and authorized by it to make such examinations and investigations to all parts of the manufacturing plants owned, used, or operated for the manufacture, transmission, or distribution of gas or electricity by any such person or corporation. * * *

PAR. 57. The commission shall appoint inspectors of electric meters, whose duty it shall be, when required by the commission, to inspect, examine, and ascertain the accuracy of any and all electric meters used or intended to be used for measuring and ascertaining the quantity of electric current furnished for light, heat, or power by any person or corporation to or for the use of any person or corporation, and to inspect, examine, and ascertain the accuracy of all apparatus for testing and proving the accuracy of electric meters; and when found to be or made to be correct the inspectors shall stamp or mark all such meters and apparatus with some suitable device, which device shall be recorded in the office of the commission. No corporation or person shall furnish, set, or put in use any electric meter the type of which shall not have been approved by the commission or any meter not approved by an inspector of the commission.

Every gas corporation and electrical corporation shall provide, repair, and maintain such suitable premises and apparatus and facilities as may be required and approved by the commission for testing and proving the accuracy of gas and electric meters furnished for use by it and by which apparatus every meter may be tested.

If any consumer to whom a meter has been furnished shall request the commission in writing to inspect such meter, the commission shall have the same inspected and tested; if the same on being so tested shall be found to be more than 4 per cent, if an electric meter, or more than 2 per cent if a gas meter, defective or incorrect to the prejudice of the consumer, the inspector shall order the gas or electrical corporation forthwith to remove the same and to place instead a correct meter, and the expense of such inspection and test shall be borne by the corporation; if the same, on being so tested, shall be found to be correct, the expense of such inspection and test shall be borne by the consumer.

The commission shall prescribe such rules and regulations to carry into effect the provisions of this paragraph as it may deem necessary, and shall fix uniform reasonable charges for the inspection and testing of meters upon complaint. (Public—No. 435. H. R. 28499. Approved, March 4, 1913.)

GEORGIA.

SEC. 6. The Railroad Commission of Georgia shall have and exercise all the power and authority heretofore conferred upon it by law, and shall have the general supervision of * * * all gas or electric light and power companies within this State; and while it may hear complaints, yet the commission is authorized to perform the duties imposed upon it of its own initiative, and to require all common carriers and other public-service companies under their supervision to establish and maintain such public service and facilities as may be reasonable and just, either by general rules or by special orders in particular cases. * * * (Georgia Code, 1911, sec. 2663.)

IDAHO.

SEC. 33. (a) The commission shall prescribe rules and regulations for the performance of any service or the furnishing of any commodity of the character furnished or supplied by any public utility, and, on proper demand and tender of rates, such public utility shall furnish such commodity or render such service within the time and upon the conditions provided in such rules.

SEC. 44. (b) The commission shall have power, after hearing had upon its own motion or upon complaint, to ascertain and fix just and reasonable standards, classifications, regulations, practices, measurements, or service to be furnished, imposed, observed, and followed by all electrical, gas, and water corporations; to ascertain and fix adequate and serviceable standards for the measurement of quantity, quality, pressure, initial voltage, or other condition pertaining to the supply of the product, commodity, or service furnished or rendered by any such public utility; to prescribe reasonable regulations for the examination and testing of such product, commodity, or service and for the measurement thereof; to establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for measurement; and to provide for the examination and testing of any and all appliances used for the measurement of any product, commodity, or service of any such public utility.

(c) Any consumer or user of any product, commodity, or service of a public utility may have any appliance used in the measurement thereof tested upon paying the fees fixed by the commission. The commission shall establish and fix reasonable fees to be paid for testing such appliances on the request of the consumer or user, the fee to be paid by the consumer or user at the time of his request, but to be paid by the public utility and repaid to the consumer or user if the appliance is found defective or incorrect to the disadvantage of the consumer or user under such rules and regulations as may be prescribed by the commission. (House Bill No. 21, Laws, 1913.)

ILLINOIS.

SEC. 49. Whenever the commission, after a hearing had upon its own motion or upon complaint, shall find that the rules, regulations, practices, equipment, appliances, facilities, or service of any public utility, or the methods of manufacture, distribution, transmission, storage, or supply employed by it, are unjust, unreasonable, unsafe, improper, inadequate, or insufficient, the commission shall determine the just, reasonable, safe, proper, adequate, or sufficient rules, regulations, practices, equipment, appliances, facilities, service, or methods to be observed, furnished, constructed, enforced, or employed, and it shall fix the same by its order, decision, rule, or regulation. The commission shall prescribe rules and regulations for the performance of any service or the furnishing of any commodity of the character furnished or supplied by any public utility.

SEC. 50. Whenever the commission, after a hearing had upon its own motion or upon complaint, shall find that additions, extensions, repairs, or improvements to, or changes in, the existing plant, equipment, apparatus, facilities, or other physical property of any public utility or of any two or more public utilities ought reasonably to be made, or that a new structure or structures should be erected, to promote the security or convenience of its employees or the public, or in any other way to secure adequate service or facilities, the commission shall make and serve an order directing that such additions, extensions, repairs, improvements or changes be made, or such structure or structures be erected in the manner and within the time specified in said order. If any additions, extensions, repairs, improvements or changes, or any new structure or structures which the commission has ordered to be erected, require joint action by two or more public utilities, the commission shall notify the said public utilities that such additions, extensions, repairs, improvements, or changes, or new structure or structures have been ordered and that the same shall be made at the

joint cost, whereupon, the said public utilities shall have such reasonable time as the commission may grant within which to agree upon the apportionment or division of cost of such additions, extensions, repairs, improvements or changes, or new structure or structures, which each shall bear. If at the expiration of such time such public utilities shall fail to file with the commission a statement that an agreement has been made for a division or apportionment of the cost or expense of such additions, extensions, repairs, improvements or changes, or new structure or structures, the commission shall have authority, after further hearing to make an order fixing the proportion of such cost or expense to be borne by each public utility and the manner in which the same shall be paid or secured.

SEC. 53. The commission is authorized to make rules and regulations concerning the conditions to be contained in and become a part of contracts for public-utility services, and any and all services concerning the same, or connected therewith. * * *

SEC. 54. The commission shall have power to ascertain, determine, and fix for each kind of public utility suitable and convenient standard commercial units of service, product, or commodity, which units shall be lawful units for the purposes of this act; to ascertain, determine, and fix adequate and serviceable standards for the measurement of quantity, pressure, initial voltage, or other condition pertaining to the performing of its service, or to the furnishing of its product or commodity by any public utility, and to prescribe reasonable regulations for examining, measuring, and testing such service, product, or commodity, and to establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for examining, measuring, or testing such service, product, or commodity. The commission may purchase such materials, apparatus, and standard measuring instruments as it deems necessary to carry out the provisions of this section.

The commission shall provide for the inspection of the manner in which every public utility conforms to the reasonable regulations prescribed by the commission, for examining, measuring, and testing its service, product, or commodity, and the commission may supplement such inspections by examining, measuring, and testing the service, product, or commodity of any public utility. Any consumer or user may have tested any appliance for examining, measuring, or testing any such service, product, or commodity upon payment of the fees fixed by the commission. The commission shall declare and establish reasonable fees to be paid for examining and testing such appliances on the request of consumers or users, the fee to be paid by the consumer or user at the time of this request, but to be paid by the public utility and repaid to the consumer or user if the measuring appliance be found unreasonably defective or incorrect to the disadvantage of the consumer or user.

The commission, its officers, agents, experts, or inspectors and employees shall have power to enter upon any premises occupied by any public utility for the purpose of making the examinations and tests provided in this act, and to set up and use on such premises any apparatus and appliances and occupy reasonable space therefor.

SEC. 57. The commission shall require that every public utility furnishing natural or artificial gas, electricity, or water to the public, where the individual consumption is measured by meter, shall, upon written request of any consumer, cause the meter reader at the time of reading such consumer's meter to leave at such meter a card showing the present reading of the meter, the last previous reading, and the dates of such two readings.

SEC. 57. *Safety of plant, appliances, etc., railroad track, etc.*—The commission shall have power, after a hearing and upon its own motion or upon complaint, by general or special orders, rules or regulations, or otherwise, to require every public utility to maintain and operate its plant, equipment, or other property in such manner as to promote and safeguard the health and safety of its employees, passengers, customers, and the public, and to this end to prescribe, among other things, the installation, use, maintenance, and operation of appropriate safety or other devices or appliances,

including interlocking and other protective devices at grade crossings or junctions and block or other systems of signalling, to establish uniform or other standards of equipment, and to require the performance of any other act which the health or safety of its employees, passengers, customers, or the public may demand.

SEC. 81. Subject to the provisions of this article, each city shall have power with respect to public utilities furnishing services, products, or commodities within the limits of such city, except railroads constituting or used as a part of a trunk line railroad system.

To regulate the quality, adequacy, and safety of any service, product, or commodity rendered or furnished within such city by any such public utility; and to require such public utility to make such additions and extensions to its plant, equipment, and property within said city as shall be reasonable and necessary in the interest of the public.

SEC. 85. This article shall not be in force in any city until the question of its adoption shall first have been submitted to the legal voters of such city and approved by a majority of those voting at such election. Until this article has been adopted and approved by the voters of such city the Illinois Commerce Commission shall be vested with all the powers and jurisdiction conferred by this act as to all public utilities within such city, and all public utilities within such city shall be subject to all the duties, obligations, and liabilities as in the case of other public utilities under the jurisdiction of such commission.

Upon the adoption of this article by any city, the authority of such city shall supersede the powers of the Illinois Commerce Commission with respect to the matters upon which the city has assumed or resumed authority hereunder.

SEC. 86. Any city may surrender the powers herein conferred upon it with respect to public utilities. On such surrender of its powers by any city, such city shall cease to exercise the powers so surrendered; and the Illinois Commerce Commission shall be vested with all powers under this act as to public utilities within such city. (Act of June 29, 1921.)

INDIANA.

SEC. 36. *Standards for measurement.*—The commission shall ascertain and fix adequate and serviceable standards for the measurement of quality, pressure, initial voltage, or other conditions pertaining to the supply of the product or service rendered by any public utility and prescribe reasonable regulations for examinations and testing of such product or service and for the measurement thereof.

SEC. 37. *Accuracy of meters, rules.*—The commission shall establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for measurements, and every public utility is required to carry into effect all orders issued by the commission relative thereto. Nothing contained in this section shall limit in any manner any powers or authority vested in municipal corporations as provided in section 110.

SEC. 38. *Testing of appliances.*—The commission shall provide for the examination and testing of any and all appliances used for the measuring of any product or service of a public utility. Any consumer or user may have any such appliance tested upon payment of the fees fixed by the commission. The commission shall declare and establish reasonable fee to be paid for testing such appliances on the request of the consumers or users, the fees to be paid by the consumer or user at the time of his request, but to be paid by the public utility and repaid to the consumer or user if the appliance or rate be found unreasonable, defective, or incorrect to the disadvantage of the consumer or user.

SEC. 39. The commission may purchase such material, apparatus, and standard measuring instruments for such examinations and tests as it may deem necessary.

SEC. 73. *Inadequate service.*—Whenever, upon investigation made under the provision of this act, the commission shall find any regulations, measurements, practices,

acts, or service to be unjust, unreasonable, unwholesome, unsanitary, unsafe, insufficient, preferential, unjustly discriminatory, or otherwise in violation of any of the provisions of this act; or shall find that any service is inadequate or that any service which can be reasonably demanded can not be obtained, the commission shall determine and declare and by order fix just and reasonable measurements, regulations, acts, practices, or service to be furnished, imposed, observed, and followed in the future in lieu of those found to be unjust, unreasonable, unwholesome, unsanitary, unsafe, insufficient, preferential, unjustly discriminatory, inadequate, or otherwise in violation of this act, as the case may be, and shall make such other order respecting such measurement, regulation, act, practice, or service as shall be just and, reasonable. (Laws 1913, chap. 76.)

KANSAS.

SEC. 22. *Units of measurement.*—The commission may ascertain and prescribe for each kind of public utility governed by the provisions of this act, suitable and convenient standard commercial units of products in service. These shall be lawful for the purpose of this act; it shall prescribe reasonable regulations for examinations and testing of such products or service and for the measurement thereof. It shall establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for measurements, and every public utility is required to carry into effect all orders issued by the commission relative thereto. (Law 1911, chap. 238.)

LOUISIANA.

The power, authority, and duties of the commission shall affect and include all matters and things connected with, concerning, and growing out of the service to be given or rendered by the common carriers and public utilities hereby, or which may hereafter be made subject to supervision, regulation, and control by the commission. The right of the legislature to place other public utilities under the control of and confer other powers upon the Louisiana Public Service Commission respecting common carriers and public utilities is hereby declared to be unlimited by any provision of this constitution.

The said commission shall have power to adopt and enforce such reasonable rules, regulations, and modes of procedure as it may deem proper for the discharge of its duties, and it may summon and compel the attendance of witnesses, swear witnesses, compel the production of books and papers, take testimony under commission, and punish for contempt as fully as is provided by law for the district courts. (Constitution of 1921, Act VI, sec. 4.)

MAINE.

SEC. 41. Upon written complaint made against any public utility by 10 persons, firms, corporations, or associations aggrieved, * * * or that any regulation, measurement, practice, or act of said public utility is in any respect unreasonable, insufficient, or unjustly discriminatory, or that any service is inadequate or can not be obtained, the commission being satisfied that the petitioners are responsible and that a hearing is expedient, shall proceed with or without notice, to make an investigation thereof. But no order affecting said rates, tolls, charges, schedules, regulations, measurements, practices, or acts complained of, shall be entered by the commission without a formal hearing.

SEC. 44. * * * If upon such public hearing it shall be found that any regulation, measurement, practice, act, or service complained of is unjust, unreasonable, insufficient, or unjustly discriminatory or otherwise in violation of any of the provisions of this act, or if it be found that any service is inadequate or that any reasonable service can not be obtained, the commission shall have power to establish and substitute therefor such other regulations, measurements, practice, service, or acts and to make such order respecting and such changes in such regulations, measure-

ments, practice, service, and acts as shall be just and reasonable. (Senate No. 453, 1913.)

MARYLAND.

SEC. 3134. Investigate and ascertain from time to time the quality of gas supplied by persons and corporations, examine the methods employed by such persons and corporations in manufacturing, selling, delivering, or supplying gas or electricity for light, heat, or power, and in transmitting the same, and have power to order such improvements as will best promote the public interest, preserve the public health and protect those using such gas or electricity and those employed in the manufacture and distribution thereof, or in the maintenance and operation of the works, wires, poles, lines, conduits, ducts, and systems in connection therewith.

Have power by order to fix from time to time such reasonable standards as it may deem proper for the measurement of the purity of gas and of the illuminating power of gas and of the heating power of gas for lighting, heating, or power purposes, whether natural gas distributed or sold, or gas manufactured, distributed, or sold by persons or gas corporations for such lighting, heating, or power purposes, and to prescribe from time to time the efficiency of the electric supply system, of the current supplied, and of the lamps furnished by the persons or electrical corporations generating and selling electric current, and by order to require said natural or other gas to equal the standards so fixed by it, and to prescribe from time to time the reasonable minimum and maximum pressure at which said natural or other gas shall be delivered by said persons or gas corporations.

The commission shall appoint inspectors of gas and electric meters, whose duty it shall be to inspect, examine, prove, and ascertain the accuracy of any and all meters used or intended to be used for measuring or ascertaining the quantity of illuminating or fuel gas, or natural gas, furnished by any gas corporation to or for the use of any person, and any and all electric meters used or intended to be used for measuring and ascertaining the quantity of electrical current furnished for light, heat, and power, by any electrical corporation to or for the use of any person or persons, and when found to be or made to be correct, the inspector shall stamp or mark all such meters and each of them with some suitable device, which device shall be recorded in the office of the secretary of state.

No corporation or person shall furnish or put into use any gas meter which shall not have been inspected, proved, and sealed, or any electric meter which shall not have been inspected, approved, stamped, or marked by an inspector of the commission. Every gas and electric corporation shall provide and keep in and upon its premises a suitable and proper apparatus, to be approved and stamped or marked by the commission, for testing and proving the accuracy of gas and electric meters furnished by it for use, and by which apparatus every meter may and shall be tested, on the written request of the consumer to whom the same shall be furnished, and in his presence if he desires it.

SEC. 32. That if any consumer to whom a meter has been furnished shall request the commission to inspect such meter, the commission shall have the same inspected and tested; if the same, on being tested, shall be found to be 4 per cent if an electric meter, or 2 per cent if a gas meter, defective or incorrect, to the prejudice of the consumer, the inspector shall order the gas or electrical corporation forthwith to remove the same and to place instead thereof a correct meter, and the expense of such inspection and test shall be borne by the corporation; if the same on being so tested shall be found to be correct, the expense of such inspection and test shall be borne by the consumer. A uniform reasonable charge shall be fixed by the commission for this service. (Act of 1910, chap. 180. Amended 1912 and 1914.)

MASSACHUSETTS.

SEC. 188. *Customer to be given meter reading.*—When a gas or electric meter in a building owned or used by a customer of a gas or electric company is read by an

employee or agent of such company, he shall, upon request, deliver to the person using the gas or electricity measured by the meter a written statement of the amount recorded by the meter at that time.

SEC. 189. *Electric meters to register plainly.*—Meters for measuring electricity for lighting purposes supplied to consumers shall register the quantity of electricity passing through them in kilowatt hours, so that the number of kilowatt hours consumed can easily be ascertained by the consumer. No charge shall be made by any person, partnership, or corporation furnishing electricity for lighting purposes for the use of a meter during any portion of 12 consecutive months, if the consumer during that time uses electricity to the value of \$9, and whoever makes a charge therefor contrary to the provisions hereof shall be punished by a fine not exceeding \$100 for each offense.

SEC. 190. *Testing electric meters in use.*—A customer of a corporation which is subject to the provisions of this act, or such corporation, may apply to the board for an examination and test of any electric meter, demand indicator, so-called, and any other device or appliance installed by such corporation upon a customer's premises and used by such corporation for the purpose of determining the charge to the customer for its service. The board shall forthwith cause such examination and test as in its judgment is practicable and reasonable to be made by a competent and disinterested person, and shall furnish to the corporation and to the customer a certificate of the result and expense thereof. If, upon such examination and test, it appears that the meter does not register correctly, the board may order the corporation to correct or remove such meter, demand indicator, or other device or appliance and to substitute a direct meter, demand indicator, or other device or appliance therefor. All fees for examinations and tests shall in the first instance be paid by the person or corporation making application therefor; but if the examination or test is made at the request of a customer, and the meter is found to be incorrect because too fast, the corporation shall pay such fees to the board, to be repaid by it to the applicant. A meter shall be deemed correct for the purposes of this section if it appears from such examination or test that it does not vary more than 5 per cent from the standard approved by the board. Nothing herein contained shall be held to authorize or prohibit differential prices for electricity supplied by any such company.

SEC. 191. *Inspector of electric meters.*—The person designated to make such examination and test may at any reasonable time enter upon the premises where the meter to be inspected is placed for the purpose of making the inspection. He shall receive such compensation for his services as the board may determine, together with his necessary traveling and other expenses, which shall be audited by the board and paid from the treasury of the Commonwealth; but the total amount of compensation and expenses shall not exceed \$3,000 in any year; and if the total amount of such compensation and expenses shall in any year exceed the amount of the fees received for such examination and tests, the excess shall be assessed and recovered from the electric companies in the manner now provided for the assessment and recovery of the other expenses of the board. All money received for fees for such examinations and tests shall be paid into the treasury of the Commonwealth monthly upon the last business day of each month. The board may establish such rules and regulations, fix such standards, prescribe such fees, and employ such means and methods in, and in connection with, such examinations and tests of electric meters as in its judgment shall be most practicable, expedient, and economical. The board may purchase such materials, apparatus, and standard measuring instruments for such examinations and tests as it may deem necessary.

SEC. 192. *Penalty for use of incorrect electric meter, etc.*—Whoever, being engaged in the sale of electricity, maintains upon the premises of a customer for the purpose of determining the charge to be made for electricity supplied to him a meter, demand indicator, or other mechanical device or appliance which is found upon examination

and test, as provided in section 190, to register incorrectly as against such customer, shall refund to him such an amount as, if not agreed upon, shall, upon application of the customer and after opportunity given to the vendor to be heard, be determined by the board.

SEC. 193. *Use of prepayment meters regulated.*—All gas and electric companies using prepayment meters shall be responsible for the loss by fire of any money deposited in said meters.

SEC. 194. *Gas or electricity may be shut off, when.*—A gas or electric company may stop gas or electricity from entering the premises of any person who neglects or refuses to pay the amount due therefor or for the use of the meter or other article hired by him from such company; and, for such purpose, the officers, servants, or workmen thereof may, after 24 hours' notice, enter his premises between the hours of 8 in the forenoon and 4 in the afternoon and separate and take away such meter or other property of the company, and may disconnect any meter, pipe, wires, fittings, or other works, whether they are the property of the company or not, from its mains, pipes, or wires.

SEC. 195. *Refusal of supply restricted.*—A gas or electric company shall not refuse to supply gas or electricity for any building or premises to a person applying therefor who is not in arrears to it for any gas or electricity previously supplied to him, because a bill for gas or electricity remains unpaid by a previous occupant of such building or premises.

SEC. 197. *Penalty for injury to electric meter, etc.*—Whoever unlawfully and intentionally injures or destroys, or suffers to be injured or destroyed, any meter, pipe, conduit, wire, line, pole, lamp or other apparatus belonging to a corporation, private or municipal, engaged in the manufacture or sale of electricity, or unlawfully and intentionally prevents an electric meter from duly registering the quantity of electricity supplied, or in any way interferes with its proper action or just registration, or, without the consent of such corporation, unlawfully and intentionally diverts any electric current from any wire of such corporation, or otherwise unlawfully and intentionally uses or causes to be used, without the consent of such corporation, any electricity manufactured or distributed by it shall, for every such offense, be punished by a fine of not more than \$100 or by imprisonment for not more than one year, or by both such fine and imprisonment. (Acts of 1914, chap. 742.)

MICHIGAN.

SEC. 1. When electricity is generated or developed by steam, water, or other power, within one county of this State, and transmitted and delivered to the consumer in the same or some other county, then the transmission and distribution of the same in or on the public highways, streets, and places, the rate of charge to be made to the consumer for the electricity so transmitted and distributed and the rules and conditions of service under which said electricity shall be transmitted and distributed shall be subject to regulation as in this act provided.

SEC. 5. The commission shall have power to inspect and examine all such electrical apparatus already installed in any public highways, streets, or places, and all such apparatus hereafter installed, and to investigate from time to time the method employed by persons, firms, or corporations transmitting and supplying electricity, and shall have power to order such improvements in such method as shall be necessary to secure good service and the safety of the public and of those employed in the business of transmitting and distributing such electricity, and of any persons liable to be injured by the erection, maintenance, and use of such apparatus.

SEC. 6. The commission shall have power in its discretion * * * to keep informed as to the methods employed by all electric utilities in the transaction of their business * * * and shall also have power to require from all electric utilities

in the State such information as the commission may need at any time in connection with the performance of the duties imposed upon it by this act.

SEC. 7. Said commission may also by order establish such rules and conditions of service as shall be just and reasonable.

(Act No. 274, Public acts of 1921. Approved May 18, 1921.)

MISSOURI.

SEC. 69. (3) Have power * * * to prescribe from time to time the efficiency of the electric supply system, of the current supplied and of the lamps furnished by the persons, corporations, or municipalities generating and selling electric current * * * for the purpose of determining whether the efficiency of the electric supply system * * * conforms to the orders issued by the commission, the commission shall have power, of its own motion, to examine and investigate the plants and methods employed in manufacturing, delivering, and supplying gas, electricity, or water.

SEC. 71. (3) The commission shall appoint inspectors of electric meters whose duty it shall be, when required by the commission to inspect, examine, and ascertain the accuracy of any and all electric meters used or intended to be used for measuring and ascertaining the quantity of electric current used for light, heat, or power by any person, corporation, or municipality to or for the use of any person or corporation, and to inspect, examine, and ascertain the accuracy of all apparatus for testing and proving the accuracy of electric meters, and when found to be, or made to be correct, the inspector shall stamp or mark all such meters and apparatus with some suitable device, which device shall be recorded in the office of the secretary of state. No corporation, person, or municipality shall furnish, set, or put in use any electric meter the type of which shall not have been approved by the commission.

(4) Every gas corporation, electrical corporation, water corporation, and municipality shall provide, repair, and maintain such suitable premises and apparatus and facilities as may be required and approved by the commission for testing and proving the accuracy of gas, water, and electric meters, furnished for use by it, and by which apparatus every meter may be tested.

(5) If any consumer to whom a meter has been furnished shall request the commission in writing to inspect such meter, the commission shall have the same inspected and tested; if the same upon being so tested shall be found to be more than 4 per cent if an electric meter, more than 2 per cent if a gas meter, and more than 5 per cent if a water meter, defective or incorrect to the prejudice of the consumer, the expense of such inspection and test shall be borne by the corporation or municipality; if the same on being so tested shall be found to be correct within the limits of error prescribed by the provisions of this subsection, the expense of such inspection and test shall be borne by the consumer.

(6) The commission may prescribe such rules and regulations to carry into effect the provisions of this section as it may deem necessary, and shall fix uniform reasonable charges for the inspection and testing of meters upon complaint. (Laws, 1913, P. S. Com. law.)

MONTANA.

SEC. 5. Every public utility is required to furnish reasonably adequate service and facilities. * * *

SEC. 10. (a) The commission shall ascertain and prescribe for each kind of public utility, suitable and convenient commercial units of product or service; these shall be lawful units for the purposes of this act.

(b) The commission shall ascertain and fix adequate and serviceable standards for the measurement of quality, pressure, initial voltage, or other conditions pertaining to the supply of the product or service rendered by any public utility and prescribe reasonable regulations for examination and testing of such product or service and for the measurement thereof.

(c) The commission shall provide for the examination and testing of any and all appliances used for the measuring of any product or service of a public utility. Any consumer or user may have any such appliance tested upon payment of the fees fixed by the commission. The commission shall declare and establish reasonable fees to be paid for testing such appliances on the request of the consumers or users, the fee to be paid by the consumer or user at the time of his request, which fees, however, shall be paid by the public utility and repaid to the complaining party, if the quality or quantity of the product or character of the service be found by the commission defective or insufficient in a degree to justify the demand for testing, or the commission may apportion the fees between the parties as justice may require.

(d) The commission may in its discretion, purchase such materials, apparatus, and standard measuring instruments for such examinations and tests as it may deem necessary. (Session Laws, 1913, chap. 52.)

NEBRASKA.

SEC. 1. All lines hereafter constructed for the transmission of electric current, including telephone and telegraph lines, on the public highways or in other places in this State, except as hereinafter provided, shall provide sufficient clearance between such lines and existing properly constructed transmission, telephone, and telegraph lines so that the reasonable safety, operation, and efficiency of existing lines shall not be interfered with.

SEC. 2. All lines hereafter built, except as hereinafter provided, for carrying electric current with a voltage of 700 volts or less, shall be constructed so as to provide a safe clearance from any existing telegraph or telephone line. If the voltage of any such line exceeds 700 volts, application to construct the same shall be made to the State Railway Commission and the projectors of such line shall file with their application a map or drawing showing the route of the proposed line and also the lines of any other company upon, across, or contiguous to the highway upon which the proposed line is to be constructed, which drawing shall give the names of the owners of such other lines, and the projectors of the proposed line shall also file specifications showing the manner of the construction of the proposed line and such other information as the commission may prescribe. Any person or company owning an existing line shall make a similar application before increasing the voltage on any such line or before stringing any additional wires or circuits thereon to carry a voltage exceeding 700 volts, and shall be subject to all of the provisions of this act.

Upon such application being filed, the commission shall notify all parties liable to be affected by the construction of such lines to appear at a public hearing, at a time and place to be fixed by the commission for hearing of such application. Any parties interested may appear, file objections, and offer evidence in support thereof: *Provided, however,* That the Railway Commission shall take into consideration the fact of the prior occupancy of the senior company: *Provided, however,* That transmission lines proposed to be built for carrying a voltage of 2,300 or less and located on the same road or street and paralleling a local telephone or telegraph line for not more than one-half mile and 2,300-volt transmission lines proposing to occupy roads or streets on which there are no telephone or telegraph lines shall not be subject to the provisions of this section, unless complaint is made to the Railway Commission by the owner of said telephone or telegraph lines.

In the event that a transmission, telephone, or telegraph company desires to construct a line under the provisions of this act on a highway, both sides of which are occupied by telephone and telegraph lines or transmission lines, the Railway Commission shall order one side of the highway vacated, and designate the side to be vacated, and shall assess the expense thereof to the parties interested in such proportions as in its judgment would best protect the rights of all parties interested and those of the general public.

Provided, further, That a proposed transmission line for carrying over 700 volts will have complied with all the requirements of this act, when built in accordance with the order and specifications of the Railway Commission for the construction of a line giving reasonable protection to existing lines. A separate order and set of specifications to be issued covering the construction of each transmission line or addition thereto.

Provided, further, That all of the above provisions of notice, procedure, etc., need not be complied with when the electric transmission, telephone and telegraph companies have agreed in writing on the details of the proposed construction and have filed signed copies of the agreement with the Railway Commission.

SEC. 3. The State Railway Commission shall have full power and authority to prohibit the construction of any line or lines found to be in violation of the terms, of section 1 of this act and after hearing, provided for in section 2, shall make such order and prescribe such terms and conditions for the location and construction and operation of the proposed lines, as to it may seem just and reasonable; and make such orders in the premises as in its judgment would best protect the rights of all parties interested and those of the general public.

It is hereby made unlawful for any person, partnership, company, association, or corporation, not specifically exempt by section 2 of this act, to begin or carry on construction of any line or lines designed to carry electric current of more than 700 volts, or to increase the voltage of any existing line to more than 700 volts, without first having secured the necessary authority from the State Railway Commission as set forth in section 2 of this act.

SEC. 4. The provisions of the existing law with regard to procedure before the State Railway Commission, and with regard to appeal from its findings shall apply to electric transmission, telephone, and telegraph lines.

SEC. 5. Any person, partnership, company, association, or corporation who shall violate any of the provisions of this act shall, upon conviction therefor, be fined in any sum not less than \$200, nor more than \$1,000 for each offense.

SEC. 6. The provisions of this act shall not apply to any line or lines within the limits of any incorporated city of the metropolitan, first or second class. (Laws of 1915, chap. 242. Approved April 12, 1917.)

NEVADA.

SEC. 13. The commission may, when necessary, ascertain and prescribe for each kind of public utility adequate, convenient, and serviceable standards for the measurement of quality, pressure, voltage or other conditions pertaining to the supply of the product or service rendered by any public utility, and prescribe reasonable regulations for the examination and testing of such products or service and for the measurement thereof. Any consumer, user or party served may have the quality or quantity of the product or the character of any service rendered by any public utility tested upon the payment of fees fixed by the commission, which fees, however, shall be paid by the public utility—and repaid to the complaining party if the quality or quantity of the product or the character of the service be found by the commission defective or insufficient in a degree to justify the demand for testing; or the commission may apportion the fees between the parties as justice may require: *Provided,* That in cities of more than ten thousand population nothing contained in this act shall direct or permit the installation or the use of mechanical water meters or similar mechanical devices to measure the quantity of water served or delivered to water users.

The commission may, in its discretion, purchase such materials, apparatus, and standard measuring instruments for such examination and tests as it may deem necessary. The commission shall have the right and power to enter upon any premises occupied by any public utility for the purpose of making the examination and tests provided for in this act and set up and use on such premises any necessary apparatus and appliances and occupy reasonable space therefor. Any public utility refusing to

allow such examination to be made as herein provided shall be subject to the penalties prescribed in section 11 of this act.

The public service commission of Nevada is authorized and directed to prescribe the standards for the maintenance, use and operation of electric poles, wires, cables, and appliances of all public utilities within the State engaged in the business of furnishing electric power, light, and energy. (Statutes of 1919, chap. 109. Approved March 28, 1919.)

NEW HAMPSHIRE.

SEC. 5. (c) Said commission shall likewise have power to investigate and ascertain from time to time, the quality of gas supplied by public utilities and methods employed by such public utilities in manufacturing or supplying gas or electricity for light, heat, or power, or in transmitting telephone or telegraph messages, or supplying water, and after notice and hearing thereon shall have power to order all reasonable and just improvements and extensions in service or methods. (Public acts, 1911, chap. 164.)

SEC. 1. (a) The public-service commission may ascertain, determine, and fix for each kind of public utility suitable and convenient standard commercial units of service, product or commodity, which units shall be lawful units for the purposes of this act.

(b) The commission may ascertain, determine, and fix adequate and serviceable standards for the measurement of quality, pressure, initial voltage, or other conditions pertaining to the performing of its service or to the furnishing of its product or commodity by any public utility, and prescribe reasonable regulations for examination and testing of such service, product, or commodity, and for the measurement thereof.

(c) The commission may ascertain, determine, and fix reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for measurement, and every public utility is required to carry into effect all orders issued by the commission relative thereto.

(d) The commission may provide for the inspection of the manner in which every public utility conforms to the reasonable regulations prescribed by the commission for examination and testing of its service, product, or commodity, and for the measurement thereof, and the commission may supplement such inspection by examinations and testing of the service, product, or commodity of any public utility, and by the measurement thereof.

(e) The commission may provide for the inspection of the manner in which every public utility has carried into effect the reasonable rules, regulations, specifications, and standards fixed by orders of the commission relative thereto, and the commission may examine and test any and all meters and appliances for measurements under such reasonable rules and regulations as it may prescribe.

(f) The commission may provide for the examination and testing of any and all appliances used for the measuring of any service, product, or commodity of a public utility. Any consumer or user may have any such appliance tested by the commission. The commission may declare and establish reasonable fees to be paid for examining and testing such appliances on the request of consumers or users, the fee to be paid by the consumer or user at the time of his request, but, if the measuring appliance be found unreasonably defective or incorrect to the disadvantage of the consumer or user, the commission shall repay such fee to the consumer or user and collect the same from the public utility.

(g) The commission may purchase such materials, apparatus, and standard measuring instruments for such examinations and tests and for the calibration and standardization of the measuring instruments used by any public utility as it may deem necessary.

SEC. 2. The commission shall fix and collect reasonable fees for examining and testing meters and other measuring apparatus and appliances and the product of any

public utility offered to the public for use or consumption, and such fees shall be paid by such public utility owning the same, or offering the same to the public, except in the cases provided for in paragraph (f) of section 1. All fees so collected shall be paid at least once each month into the State treasury, with an itemized statement of the same, and shall, without further legislative act, stand appropriated for use by the commission for the payment of experts, clerks, and assistants.

SEC. 3. This act shall take effect upon its passage. (Public acts, 1913, chap. 124.)

NEW JERSEY.

SEC. 16. The board shall have power: (e) After hearing, by order in writing, to fix just and reasonable standards, classifications, regulations, practices, measurements, or service to be furnished, imposed, observed, and followed thereafter by any public utility as herein defined; (f) after hearing, by order in writing, to ascertain and fix adequate and serviceable standards for the measurement of quantity, quality, pressure, initial voltage, or other condition pertaining to the supply of the product or service rendered by any public utility as herein defined, and to prescribe reasonable regulations for examination and test of such product or service and for the measurement thereof; (g) after hearing, by order in writing, to establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for measurements; (h) to provide for the examination and test of any and all appliances used for the measuring of any product or service of a public utility as herein defined; (j) to fix the fees to be paid by any consumer or user of any product or service of a public utility as herein defined, who may apply to said board for such examination or test to be made, and any consumer or user may have any such appliance tested upon the payment of the fees fixed by the board, which fees shall be repaid to the consumer or user if the appliance be found defective or incorrect to the disadvantage of the consumer or user and in that event paid by the public utility. (Laws, 1911, chap. 195.)

NEW YORK.

§65. *Safe and adequate service; just and reasonable charges; unjust discrimination; unreasonable preference.*—1. Every gas corporation, every electrical corporation, and every municipality shall furnish and provide such service, instrumentalities, and facilities as shall be safe and adequate and in all respects just and reasonable. * * *

§66. *General powers of commission in respect to gas and electricity.*—3. The commission shall have power * * * to prescribe from time to time the efficiency of the electric supply system, of the current supplied and of the lamps furnished by the persons, corporations, or municipalities generating and selling electric current, and by order to require the gas so manufactured, distributed, or sold to equal the standards so fixed by it, and to prescribe from time to time the reasonable minimum and maximum pressure at which gas shall be delivered by said persons, corporations, or municipalities. For the purpose of determining whether the gas manufactured, distributed, or sold by such persons, corporations, or municipalities for lighting, heating, or power purposes conforms to the standards of illuminating power, heating power, purity, and pressure, and for the purpose of determining whether the efficiency of the electric supply system of the current supplied and of the lamps furnished conforms to the orders issued by the commission, the commission shall have power, of its own motion, to examine and investigate the plants and methods employed in manufacturing, delivering, and supplying gas or electricity, and shall have access through its members or persons employed and authorized by it to make such examinations and investigations to all parts of the manufacturing plants owned, used, or operated for the manufacture, transmission, or distribution of gas or electricity by any such person, corporation, or municipality.

12. Have power to require every gas corporation, electrical corporation, and municipality to file with the commission and to print and keep open to public inspection

schedules showing all rates and charges made, established or enforced, or to be charged or enforced, all forms of contract or agreement and all rules and regulations relating to rates, charges, or service used or to be used, and all general privileges and facilities granted or allowed by such gas corporation, electrical corporation, or municipality; but this subdivision shall not apply to State, municipal, or Federal contracts.

§67. 3. The commission shall appoint inspectors of electric meters whose duty it shall be, when required by the commission, to inspect, examine, and ascertain the accuracy of any and all electric meters used or intended to be used for measuring and ascertaining the quantity of electric current furnished for light, heat, or power by any person, corporation, or municipality to or for the use of any person or corporation, and to inspect, examine and ascertain the accuracy of all apparatus for testing and proving the accuracy of electric meters, and when found to be or made to be correct the inspector shall stamp or mark all such meters and apparatus with some suitable device, which device shall be recorded in the office of the secretary of state. No corporation, person, or municipality shall furnish, set or put in use any electric meter the type of which shall not have been approved by the commission.

4. Every gas corporation, electrical corporation, and municipality shall provide, repair, and maintain such suitable premises and apparatus and facilities as may be required and approved by the commission for testing and proving the accuracy of gas and electric meters furnished for use by it, and by which apparatus every meter may be tested.

5. If any consumer to whom a meter has been furnished shall request the commission in writing to inspect such meter, the commission shall have the same inspected and tested; if the same on being so tested shall be found to be more than four per centum if an electric meter, or more than two per centum if a gas meter, defective or incorrect to the prejudice of the consumer, the expense of such inspection and test shall be borne by the corporation or municipality, if the same on being so tested shall be found to be correct within the limits of error prescribed by the provisions of this subdivision, the expense of such inspection and test shall be borne by the consumer.

6. The commission shall prescribe such rules and regulations to carry into effect the provisions of this section as it may deem necessary, and shall fix uniform reasonable charges for the inspection and testing of meters upon complaint.

NORTH CAROLINA.

SEC. 2. That the said commission shall have full power and authority to fix, establish, and regulate the rates or charges of such persons, companies, or corporations, to make such investigations and orders, and establish and enforce rules, regulations, fines, and penalties as it has over railroads.

SEC. 6. The corporation commission shall make reasonable and just rules and regulations: (1) To prevent discrimination in furnishing electricity, electric light, current, power, or gas; (2) to prevent the giving, paying, or receiving of any rebate or bonus, directly or indirectly, or the misleading or deceiving of the public in any manner as to real rates or charges for electricity, electric light, current, power, or gas.

SEC. 7. It is the intention of this act to give the said corporation commission the same control, power, and supervision over such persons, companies, and corporations named in this act as it has over railroad corporations in this State. (Chap. 127, Public Laws, session 1913.)⁶²

NORTH DAKOTA.

SEC. 5. Whenever the commissioners shall find, after hearing, that the rules, regulations, practices, equipment, appliances, facilities, or service of any public utility

⁶² See further the act of Feb. 15, 1909, "An act to provide for the appointment of inspectors of electric, gas, and water utilities." An error of 2½ per cent is specified for all kinds of gas, water, and electric meters in this act.

or the methods of manufacture, distribution, transmission, storage, or supply employed by it are unjust, unreasonable, unsafe, improper, inadequate, or insufficient, the commissioners shall determine the just, reasonable, safe, proper, adequate or sufficient rules, regulations, practices, equipment, appliances, facilities, service, or methods to be observed, furnished, constructed, enforced or employed, and shall, after hearing, fix the same by its order, rule, or regulation. The commission shall prescribe, after hearing, rules and regulations for the performance of any service or the furnishing of any commodity of a character furnished or supplied by any public utility and, on demand and tender of rates, such public utility shall furnish such commodity, and render such service within the time and upon the conditions provided in such rules.

SEC. 9. The commissioners and their officers and employees shall have the power to enter upon any premises occupied by any public utility for the purpose of making examinations and tests and exercising any of the powers provided for in this act and set out and use on said premises any weights or appliances necessary therefor. Any consumer or user of any produce or commodity or service of a public utility may have any appliance used in the measurement thereof tested by paying the fees fixed by the commissioners. The commissioners shall establish and fix reasonable fees to be paid for testing such appliances. The commissioners shall have the power to ascertain and fix just and reasonable standards, classifications, regulations, practices, measurements, or services to be furnished, imposed, observed, and followed by all public utilities; to ascertain and fix adequate and serviceable standards for the measurements, quantity, quality, pressure, initial voltage or other condition pertaining to the supply of the product, commodity or service furnished or rendered by any such public utility; to prescribe reasonable regulations for the examination and testing of such products, commodity or service and for the measurement thereof, to establish reasonable rules, regulations, specifications and standards to secure the accuracy of all meters and appliances for the measurements, and to provide for the examination and testing of any and all such appliances used for the examination of any product, commodity or service of any public utility.

SEC. 13. Every public utility shall furnish, provide and maintain such service, instrumentalities, equipment and facilities as shall promote the safety, health, comfort, and convenience of its patrons, employees, and the public, and as shall be in all respects adequate, convenient, just and reasonable and without any unjust discrimination or preference. (Sixteenth session. chap. 192. March 5, 1919.)

OHIO.

SEC. 614-34. The commission shall ascertain and prescribe suitable and convenient standard commercial units of the product or service of any public utility, when the character of its product or service is such that it can be determined, and such units shall be the lawful units for the purposes of this act.

SEC. 614-36. The commission may ascertain and fix adequate and serviceable standards for the measurement of quality, pressure, initial voltage, or other condition pertaining to the supply or quantity or the product or service rendered by any public utility and prescribe reasonable regulations for examination and testing of such product or service and for the measurement thereof. It may establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for measurements and every public utility is required to carry into effect all orders issued by the commission relative thereto.

SEC. 614-37. The commission may provide for the examination and testing of any and all appliances used for the measurement of any product or service of a public utility. Any consumer or user may have any such appliance tested upon the payment of the fees fixed by the commission. The commission may declare and establish reasonable fees to be paid for testing such appliances on the request of consumers or

users, the fees to be paid by the consumer or user at the time the request is made, but to be paid by the public utility and repaid to the consumer or user if the appliance be found to be commercially defective or incorrect to the disadvantage of the consumer or user. (Laws of Ohio, relating to the public utilities commission, 1913.)

SEC. 9334. No person, firm, or corporation engaged in the business of furnishing gas, water, or electricity to consumers of such products shall demand or require a consumer to deposit cash in any sum whatever as security for the payment of any bills for any such commodity to be so furnished, if the proposed consumer be a freeholder who is financially responsible or a person who is able to give a reasonable safe guaranty in an amount sufficient to secure the payment of bills for 50 days' supply. In case no such security can be furnished, a deposit not exceeding the amount of the monthly average of the annual consumption by such consumer plus 30 per cent may be required, upon which deposit there shall be allowed and paid to the consumer interest at the rate of 6 per cent per annum, provided it remains on deposit six consecutive months. (R. S. sec. 3559a.)

SEC. 9335. The making of any rule, regulation, or requirement in conflict with any of the provisions of the preceding section is strictly forbidden, and hereby declared to be unlawful. (R. S. sec. 3559a.)

SEC. 9336. Any person, firm, or corporation violating any of the provisions of the second preceding section, upon conviction thereof, shall forfeit all right to collect or receive any sum whatever from such consumer for gas, water, or electricity so furnished. (R. S. sec. 3559b.)

SEC. 8975. The public utilities commission shall, within six months after this act takes effect, determine standards of maintenance and operation and also the nature, location, and character of the construction to be used where telegraph, telephone, electric light, power, or other electric wires of any kind, cross or more or less parallel the line of a railroad, interurban railway, or other public utility, and to this end shall formulate, and from time to time issue rules and regulations and complete detailed specifications, covering each class of construction, maintenance, and operation of such electric wire crossing and (or) parallel, under the various conditions existing; and the commission, upon complaint of any person, railroad, interurban railway, or public utility, claiming to be injuriously affected or subjected to hazard, shall, after hearing, make such order and prescribe such terms and conditions for the construction, maintenance, and operation of the lines, plants, or systems, as to it may seem just and reasonable.

SEC. 8976. The public utilities commission shall see that the provisions of the next preceding section are enforced, and for that purpose shall have power to cause the removal of such telegraph, telephone, electric light, power, or other electric wires of any kind crossing or paralleling such other line and not in accordance with the rules, regulations, and specifications issued by said commission. (Sections of General Code, as amended. Approved June 7, 1921.)

OKLAHOMA.

SEC. 2. The commission shall have general supervision over all public utilities, with power to fix and establish rates and to prescribe rules, requirements, and regulations, affecting their services, operation, and the management and conduct of their business; shall inquire into the management of the business thereof, and the method in which same is conducted. It shall have full visitatorial and inquisitorial power to examine such public utilities, and keep informed as to their general conditions, their capitalization, rates, plants, equipments, apparatus, and other property owned, leased, controlled or operated, the value of the same, the management, conduct, operation, practices and services; not only with respect to the adequacy, security and accommodation afforded by their service, but also with respect to their compliance with the provisions of this act, and the constitution and laws of this State, and with the orders of the commission.

SEC. 5. The commission may, from time to time, adopt or promulgate such orders, rules, regulations, or requirements, relative to investigations, inspections, tests, audits, and valuations of the plants and properties relative to inspection and tests of meters as in its judgment may be necessary and proper. * * * (House Bill 156, 1913.)

OREGON.

SEC. 500. *Units of product or service.*—The commission shall ascertain and prescribe for each kind of public utility suitable and convenient standard commercial units of product or service. These shall be lawful units for the purposes of this act.

SEC. 501. *Standards for measurement, accurate appliances.*—The commission shall ascertain and fix adequate and serviceable standards for the measurement of quality, pressure, initial voltage, or other conditions pertaining to the supply of the product or service rendered by any public utility and prescribe reasonable regulations for examination and testing of such product or service and for the measurement thereof. It shall establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for measurements and every public utility is required to carry into effect all orders issued by the commission relative thereto.

SEC. 502. *Testing of measuring appliances.*—The commission shall provide for the examination and testing of any and all appliances used for the measuring of any product or service of a public utility, and may provide by rules that no such appliance shall be installed and used for the measuring of any product or service of any public utility until the same has been examined and tested by the commission and found to be accurate. * * *

The commission may purchase such materials, apparatus, and standard measuring instruments for such examinations and tests as it may deem necessary. (Laws 1911, chap. 279.)

PENNSYLVANIA.

ART. II, SEC. 1. (*w*) If a gas corporation, water corporation, or other public-service company, furnishing its service or product upon meter or other similar measurement, or electric corporation, to provide and keep in and upon its premises, suitable and proper apparatus to be approved from time to time and stamped or marked by the commission, for testing and proving the accuracy of gas, water, electric, or other meters furnished by it for use; and by which apparatus every meter may be tested upon the written request of the consumer to whom the same shall be furnished, and in his presence if he shall so desire. If the meter so tested shall be found to be accurate, within such commercially reasonable limits as the commission may, by general or special order, fix for such meters, or class of meters, a reasonable fee, to be fixed by the commission by standing order, sufficient to cover the cost of such test, shall be paid by the consumer requiring such test, but if not so found then the cost thereof shall be borne by the public-service company furnishing said meter.

ART. V, SEC. 1. Said power and authority shall include power to inquire into and regulate the * * * quantity or quality of water, gas, electricity or light, heat or power supplied.

SEC. 2. Whenever the commission shall determine, after hearing, had upon its own motion, or upon complaint, * * * that the service, facilities * * * are unsafe, inadequate, insufficient, unjust, or unreasonable, * * * the commission shall determine, and specify by an order in writing * * * the just, reasonable, safe, adequate, and sufficient service, facilities, rules, regulations, or practices * * *.

SEC. 13. The commission may, after hearing had upon its own motion or upon complaint, establish such standards of facilities and service of public service companies as shall be reasonably necessary for the safety, accommodation, or convenience of its patrons, employees, and the public; and require by an order to be served in the manner hereinafter provided upon every public service company affected thereby,

the facilities or service of such public service companies to conform to such standards. The commission shall also have power, after hearing had upon its own motion or upon complaint, to require public service companies to make all such repairs, changes, alterations, additions, extensions, and improvements, in and about their facilities and service, as shall be reasonably necessary and proper for the safety, accommodation, convenience, and service of their patrons, employees, and the public. (Act of July 26, 1913, No. 854.)

RHODE ISLAND.

SEC. 22. *Regulation of service.*—If upon such a hearing and investigation had under the provisions of this act, the commission shall find that any regulation, measurement, practice, act or service of any public utility is unjust, unreasonable, insufficient, preferential, unjustly discriminatory or otherwise in violation of any of the provisions of this act, or that any service of any such public utility is inadequate or that any service which can be reasonably demanded, can not be obtained, the commission shall have power to substitute therefor such other regulations, measurements, practices, service or acts, and to make such order respecting and such changes in such regulations, measurements, practices, service or acts, as shall be just and reasonable.

SEC. 38. *Charges and service.*—Every public utility is required to furnish safe, reasonable, and adequate services and facilities * * *.

SEC. 45. *Standards of quality of products and service.*—The commission may, after having given any public utility concerned a reasonable notice and an opportunity to be heard, determine and fix by order the standard amount, quality, pressure, initial voltage and character of each kind of product or service to be furnished or rendered by any public utility, and standard condition or conditions pertaining to furnishing or rendering the same, and thereafter the public utility concern shall furnish and render the same accordingly, but with and subject to the right of appeal given by section 34 hereof.

SEC. 46. *Standard measurements.*—The commission shall ascertain and fix adequate and serviceable standards for the measurement of the quality, pressure, initial voltage, or other condition pertaining to the supply of the product or service rendered by any public utility and prescribe reasonable regulations for the examination and testing of such product or service and for the measurement thereof. It shall establish reasonable rules, regulations, specifications, and standards to secure accuracy of all meters and appliances for measurement, and every public utility is required to carry into effect all orders issued by the commission relative thereto.

SEC. 47. *Measuring instruments, testing, etc.*—The commission shall provide for the examination and testing of any and all appliances used for measuring any product or service of any public utility. Any consumer or user may have any such appliances tested upon payment of the fees fixed by the commission. The commission shall declare and establish reasonable fees to be paid for the testing of such appliances on the request of the consumers or users, the fee to be paid by the consumer or user at the time of his request, but to be paid by the public utility and repaid to the consumer or user if the appliances be found defective or incorrect or to the disadvantage of the consumer or user. A meter shall be deemed correct for the purposes of this section if it appears from such examination or test that it does not vary more than 2 per cent from the standard approved by the commission. (Public Laws, 1912, chap. 795.)

SOUTH CAROLINA.

SEC. 6. The railroad commission is hereby vested with power and jurisdiction to supervise and regulate the rates and service of every public utility in this State, and to fix such just and reasonable standards, classifications, regulations, practices and measurements of service to be furnished, imposed or observed and followed by every public utility in this State. (Acts, 1922. Approved March 6, 1922.)

TENNESSEE.

SEC. 4. That the * * * commission shall have power: * * *.

After hearing, by order in writing, to fix just and reasonable standards, classifications, regulations, practices or services to be furnished, imposed, observed, and followed thereafter by any public utility as herein defined.

After hearing, by order in writing, to ascertain and fix adequate and serviceable standards for the measurement of quantity, quality, pressure, voltage, or other conditions, pertaining to the supply of the product or service rendered by any public utility as herein defined, and to prescribe reasonable regulations for examination and test of such product or service and for the measurement thereof.

After hearing, by order in writing, to establish reasonable rules and regulations, specifications and standards, to secure an accuracy of all meters and appliances for measurements.

To provide for the examination and test of any appliance used for the measuring of any product or service of a public utility as herein defined, and by its agents or examiners to enter upon any premises occupied by any public utility as herein defined, for the purpose of making the examinations and tests provided for in this act.

To fix the fees to be paid by any consumer or user of any product or service of a public utility as herein defined, who may apply to said commission for such examination, or test to be made, and any consumer or user may have any such appliance tested upon the payment of the fees fixed by the commission, which fees shall be repaid to the consumer or user if the appliance be found defective or incorrect to the disadvantage of the consumer or user and in that event such fees shall be paid by the public utility concerned.

SEC. 5. *Be it further enacted*, That the Railroad and Public Utilities Commission of Tennessee shall have power after hearing upon notice, by order in writing, to require every public utility as herein defined:

To furnish safe, adequate, and proper service and to keep and maintain its property and equipment in such condition as to enable it to do so.

To establish, construct, maintain, and operate any reasonable extension of its existing facilities where, in the judgment of said commission, such extension is reasonable and practicable and will furnish sufficient business to justify the construction, operation, and maintenance of the same, and when the financial condition of the public utility affected reasonably warrants the original expenditure required in making such extension, or to abandon any service when, in the judgment of the commission, the public welfare no longer requires it. (Chap. 49. Approved Feb. 21, 1919.)

UTAH.

ART. III. SEC. 1 (b) Every public utility shall furnish, provide, and maintain such service, instrumentalities, equipment, and facilities as shall promote the safety, health, comfort, and convenience of its patrons, employees, and the public, and as shall be in all respects adequate, efficient, just, and reasonable.

ART. IV. SEC. 6. Whenever the commission shall find, after hearing, that the rules, regulations, practices, equipment, appliances, facilities, or service of any public utility, or the methods of manufacture, distribution, transmission, storage, or supply, employed by it, are unjust, unreasonable, unsafe, improper, inadequate, or insufficient the commission shall determine the just, reasonable, safe, proper, adequate, or sufficient rules, regulations, practices, equipment, appliances, facilities, service, or methods to be observed, furnished, constructed, enforced, or employed, and shall fix the same by its order, rule, or regulation. The commission shall prescribe, after hearing, rules and regulations for the performance of any service or the furnishing of any commodity of the character furnished or supplied by any public utility, and on proper demand and tender of rates, such public utility shall furnish such commodity

or render such service within the time and upon the conditions provided in such rules.

SEC. 7. Whenever the commission shall find that additions, extensions, repairs, or improvements to, or changes in the existing plant, equipment, apparatus, facilities, or other physical property of any public utility or of any two or more public utilities ought reasonably to be made, or that a new structure or structures should be erected, to promote the security of convenience of its employees or the public, or in any other way to secure adequate service or facilities, the commission shall make and serve an order directing that such additions, extensions, repairs, improvements, or changes be made or such structure or structures be erected in the manner and within the time specified in said order. If any additions, extensions, repairs, improvements, or changes, or any new structure or structures which the commission has ordered to be erected, require joint action by two or more public utilities, the commission shall notify the said public utilities that such additions, extensions, repairs, improvements, or changes or new structure or structures have been ordered and that the same shall be made at their joint cost, whereupon the said public utilities shall have such reasonable time as the commission may grant within which to agree upon the portion or division of cost of such additions, extensions, repairs, improvements, or changes or new structure or structures, which each shall bear. If at the expiration of such time such public utilities shall fail to file with the commission a statement that an agreement has been made for a division or apportionment of the cost or expense of such additions, extensions, repairs, improvements, or changes, or new structure or structures, the commission shall have authority after further hearing, to make an order, fixing the proportion of such cost or expense to be borne by each public utility and the manner in which the same shall be paid or secured.

SEC. 13. The commission shall have power, by general or special orders, rules, or regulations, or otherwise, to require every public utility to construct, maintain, and operate its line, plant, system, equipment, apparatus, tracks, and premises in such manner as to promote and safeguard the health and safety of its employees, passengers, customers, and the public, and to this end to prescribe, among other things, the installation, use, maintenance, and operation of appropriate safety or other devices or appliances, including interlocking and other protective devices, at grade crossings or junctions, and block or other system of signaling, to establish uniform or other standards of construction and equipment, and to require the performance of any other act which the health or safety of its employees, passengers, customers, or the public may demand.

SEC. 17. (a) The commission shall have the power, after hearing, to ascertain and fix just and reasonable standards, classifications, regulations, practices, measurements, or service to be furnished, imposed, observed, and followed by all electrical, gas and water corporations; to ascertain and fix adequate and serviceable standards for the measurement of quantity, quality, pressure, initial voltage, or other condition pertaining to the supply of the product, commodity, or service furnished or rendered by any such public utility; to prescribe reasonable regulations for the examination and testing of such product, commodity, or service, and for the measurement thereof; to establish reasonable rules, regulations, specifications and standards to secure the accuracy of all meters and appliances for measurements; and to provide for the examination and testing of any and all appliances used for the measurement of any product, commodity, or service of any such public utility.

(b) The commissioners and their officers and employees shall have power to enter upon any premises occupied by any public utility, for the purpose of making the examination and tests and exercising any of the other powers provided for in this act, and to set up and use on such premises any apparatus and appliances necessary therefor. The agents and employees of such public utility shall have the right to be present at the making of such examinations and tests.

(c) Any consumer or user of any product, commodity, or service of a public utility may have any appliance used in the measurement thereof tested, upon paying the fees fixed by the commission. The commission shall establish and fix reasonable fees to be paid for testing such appliances on the request of the consumer or user, the fee to be paid by the consumer or user at the time of his request, but to be paid by public utility and repaid to the consumer or user if the appliance is found defective or incorrect to the disadvantage of the consumer or user, under such rules and regulations as may be prescribed by the commission. (Laws of Utah, 1917, chap. 47.)

VERMONT.

SEC. 9. The public-service commission shall have jurisdiction, on due notice, to hear, determine, render judgment, and make orders and decrees * * * in all matters respecting: (1) The purity, quantity, or quality, of any product furnished or sold by any company under supervision, as provided in this act, and may prescribe the equipment for and standard of measurement, pressure, initial voltage of such product. (Acts, 1909, No. 116.)

VIRGINIA.

1.—(b) It shall be the public duty of every public utility to furnish reasonably adequate service and facilities at reasonable and just rates to any person, firm, or corporation along its lines desiring same and not engaged in a similar business, and to charge uniformly therefor all persons or corporations using such product under like conditions, and not in competition with such furnishing company.

But nothing herein contained shall be construed as applicable to schedules of rates or contracts for service rendered by any such company to any municipal corporation or to the State or Federal Government.

2. *Public utility defined.*—The term "public utility" as used in this act shall mean and embrace every corporation other than a municipality, company, individual, or association of individuals, their lessees, trustees, or receivers appointed by any court whatsoever that now or hereafter may own, operate, manage, or control any plant or equipment or any part of a plant or equipment within the State for the conveyance of telephone messages for the production, transmission, delivery, or furnishing of heat, light, water, or power either directly or indirectly to or for the public. *Provided*, the term public utility as herein defined shall not be construed to include any hotel or corporation whose principal business is the operation of a hotel and which may supply heat, light, water, or power to a limited number of patrons out of its temporary surplus. (As amended, acts 1918, p. 413.)

3. *Service defined.*—The term "service" is used in this act in its broadest and most inclusive sense, and includes not only the use of accommodations afforded consumers or patrons but also any product or commodity furnished by any public utility and equipment, apparatus, appliances, and facilities devoted to the purposes in which such public utility is engaged and to the use and accommodation of the public.

5. *Tests and equipment therefor.*—That the State corporation commission may purchase such materials, apparatus, and standard measuring instruments for such examinations and tests as it may deem necessary, and may provide for the examination and testing of the service or any part thereof of any public utility in this State at such time and under such circumstances as the State corporation commission may deem best.

6. *Report by utilities; items.*—The State corporation commission, with or without an investigation, may require any public utility to furnish to the said State corporation commission in such form, at such times, and in such detail as the commission shall require, such accounts, reports, and other information of whatsoever kind or character as said State corporation commission may deem proper and in such form and detail as it may prescribe, in order to show completely the entire operation of the public utility in furnishing the unit of its product or service to the public.

The State corporation commission shall ascertain and prescribe for each kind of public utility suitable standard commercial units of products or service. These shall be lawful units for the purposes of this act.

7. * * * If upon investigation it shall be found that any regulation, measurement, practice, act, or service of any public utility operating in this State complained of is unjust, unreasonable, insufficient, preferential, unjustly discriminatory, or otherwise in violation of any of the provisions of this act, or if it be found that any service is inadequate or that any reasonable service can not be obtained, the State corporation commission shall have power to substitute therefor such other regulations, measurements, practices, service, or acts and to make such order respecting and such changes in such regulations, measurements, practices, service, or acts as shall be just and reasonable. (Chap. 340. Approved Mar. 27, 1914.)

WASHINGTON.

SEC. 26. *Duties of gas, electrical, and water companies.*—Every gas company, electrical company, and water company shall furnish and supply such service, instrumentalities, and facilities as shall be safe, adequate, and efficient and in all respects just and reasonable.

All rules and regulations issued by any gas company, electrical company, or water company, affecting or pertaining to the sale or distribution of its products, shall be just and reasonable.

SEC. 74. *Inspectors of gas, electric, and water meters.*—The commission may appoint inspectors of electric meters, whose duty it shall be when required by the commission to inspect, examine, prove, and ascertain the accuracy of any and all electric meters used or intended to be used for measuring and ascertaining the quantity of electrical current furnished for light, heat, or power by any public-service company to or for the use of any person or corporation, and to inspect, examine, and ascertain the accuracy of all apparatus for testing and proving the accuracy of electric meters, and when found to be or made to be correct the inspector shall stamp or mark all such meters and apparatus with some suitable device to be prescribed by the commission. No public-service company shall furnish, set, or put in use any electric meters, the type of which shall not have been approved by the commission.

Every gas company, electrical company, and water company shall prepare and maintain such suitable premises, apparatus, and facilities as may be required and approved by the commission for testing and proving the accuracy of gas, electric, or water meters furnished for use by it, by which apparatus every meter may be tested.

If any customer to whom a meter has been furnished shall request the commission in writing to inspect such meter, the commission shall have the same inspected and tested, and if the same on being so tested shall be found to be more than 4 per cent if an electric meter, or more than 2 per cent if a gas meter, or more than 2 per cent if a water meter, defective or incorrect to the prejudice of the consumer, the expense of such inspection and test shall be borne by the gas company, electrical company, or water company, and if the same on being so tested shall be found to be correct within the limits of error prescribed by the provisions of this section, the expense of such inspection and test shall be borne by the consumer.

The commission shall prescribe such rules and regulations to carry into effect the provisions of this section as it may deem necessary, and shall fix the uniform and reasonable charges for this inspection and testing of meters upon complaint. (Laws of 1911, chap. 117.)

SEC. 21. The department of public works shall be organized into and consist of three divisions, to be known, respectively, as (1) the division of transportation, (2) the division of public utilities, and (3) the division of highways.

SEC. 23. The director of public works shall appoint and deputize an assistant director, to be known as the supervisor of public utilities, who shall have charge and

supervision of the division of public utilities, and, with the approval of the director, shall have power to appoint and employ such inspectors, engineers, experts, and clerical and other assistants as may be necessary to carry on the work of the division. (Laws of 1921, chap. 7.)

WEST VIRGINIA.

SEC. 10. The commission shall have general supervision of all persons, firms, or corporations having authority under any charter or franchise of any city, town, or municipality, county court or tribunal in lieu thereof, or otherwise, to lay down and maintain wires, pipes, conduits, ducts, or other fixtures in, over, or under streets, highways, or public places for the purpose of furnishing and transmitting electricity for light, heat, or power, or maintaining underground conduits or ducts for electrical conductors, or for telegraph or telephone purposes, and for the purpose of furnishing water, either for domestic or power purposes, and of oil and gas pipe lines.

The commission may ascertain the quantity, healthfulness, and quantity of the water or quality and quantity of gas or electricity supplied by such persons, firms, or corporations, and examine the methods employed, and shall have power to order such improvements as will best promote the public interests and preserve the public health.

The commission shall have power, through its members, inspectors, or employees to enter in, upon, and to inspect the property, buildings, plants, fixtures, power houses, and offices of any such persons, firms, corporations, or municipalities, and shall have power to examine the books and affairs to be investigated by it, and shall have the power, either as a commission or by any of its members, to subpoena witnesses and take testimony and administer oaths to any witness in any proceeding or examination instituted before it or conducted by it in reference to any matter within its jurisdiction. The commission shall, when and as necessary, appoint inspectors of gas, electric, and water meters, whose duty shall be when required to inspect, examine, prove, and ascertain the accuracy of any gas, electric, or water meters used or intended to be used for measuring or ascertaining the quantity of gas, electricity, or water furnished to, by, or for the use of any person, firm, or corporation, and when found to be correct, or made so, the inspector shall stamp or mark each of such meters with some suitable device, which device shall be recorded in the office of the commission. No person, firm, or corporation shall furnish or put in use any gas, electric, or water meter which shall not have been inspected, proved, and stamped or marked by an inspector of the commission: *Provided*, That in case of emergency gas, electric, or water meters may be installed and used before being inspected, but notice thereof shall be immediately given to the public-service commission by the public-service corporation installing the same, and such meters shall be inspected, proved, and stamped or marked, as soon thereafter as practicable. Every gas, electric, and water company or corporation shall provide and keep in and upon its premises suitable and proper apparatus, to be approved and stamped or marked by the commission, for testing and proving the accuracy of gas, electric, and water meters furnished for use by it and by which apparatus every meter may and shall be tested on the written request of the consumer to whom the same shall be furnished, and in his presence if he so desires.

If any person, firm, or corporation to or by whom a meter has been furnished shall request the commission in writing to inspect such meter, the commission shall have the same inspected and tested. If the same on being tested shall be found to be 2 per cent from being correct, or to the prejudice of the user, the inspector shall order the owner of such meter forthwith to remove the same and to place instead thereof a correct meter, and the expense of such inspecting and testing shall be borne by the owner. If the meter, on being so tested, shall be found to be correct, or within 2 per cent of being correct, as above provided, the expense of such inspection and testing shall be borne by the user. A uniform charge and rule shall be fixed by the commission for this service.

Provided, That nothing in this act shall prevent the commission from changing and modifying the method of inspecting meters and adopting such rules and regulations therefor as to the commission may seem just and proper. (Acts of 1915.)

WISCONSIN.

SEC. 1797, m. 23. *Standard measurements, accurate appliances.*—1. The commission shall ascertain and fix adequate and serviceable standards for the measurement of quality, pressure, initial voltage, or other conditions pertaining to the supply of the product or service rendered by any public utility and prescribe reasonable regulations for examination and testing of such product or service and for the measurement thereof.

2. It shall establish reasonable rules, regulations, specifications, and standards to secure the accuracy of all meters and appliances for measurements, and every public utility is required to carry into effect all orders issued by the commission relative thereto.

SEC. 1797, m. 24. *Measuring instruments, testing, fees.*—1. The commission shall provide for the examination and testing of any and all appliances used for the measuring of any product or service of a public utility.

2. Any consumer or user may have any such appliance tested upon payment of the fees fixed by the commission.

3. The commission shall declare and establish reasonable fees to be paid for testing such appliances on the request of the consumers or users, the fee to be paid by the consumer or user at the time of his request, but to be paid by the public utility and repaid to the consumer or user if the appliance be found defective or incorrect to the disadvantage of the consumer or user.

SEC. 1797, m. 25. *Public equipment for tests.*—The commission may purchase such materials, apparatus, and standard measuring instruments for such examinations and tests as it may deem necessary. (Laws of 1907, chap. 499.)

WYOMING.

SEC. 38. *Service adequate.*—The service and facilities of every public utility shall be adequate and safe and every service regulation shall be just and reasonable. It shall be unlawful for any public utility to make or permit to exist any unjust discrimination or undue preference with respect to its service, facilities, or service regulations.

SEC. 40. *Equipment adequate—safety—crossings.*—All instrumentalities, equipment, plant, and facilities furnished, employed, or used by any public utility, shall in all respect be adequate and efficient, and the construction, operation, and use thereof shall be such as shall prevent injury to property, and as shall promote the safety, health, comfort, and convenience of its patrons, employees, and the public, and to this end the commission may make rules and regulations governing the overhead construction of telephone, telegraph, trolley, electric light, and power lines hereafter built within this State. Said commission shall also have the power to direct the manner by which all utilities shall cross public highways and other utilities and by which public highways shall cross the utilities, and to prescribe methods of approach and crossing that shall secure safety to the public. At every such crossing, in case the person interested do not themselves agree, it shall be the duty of the commission to apportion between the parties, in accordance with justice, the costs and expenses of installing and maintaining such crossings. In case expense is apportioned to be paid by a public highway, the portion so to be paid by such highway shall be paid by the city or town in case the crossing line is within the boundaries of a city or town, and by the county in which the crossing is situated in case the same is not within any city or town. (Chap. 146, Session laws 1915.)

3. Sections of Laws Relating to Accidents and Safety Provisions.

[The laws of certain States referring only to accidents on railroads and street railways are omitted, the purpose of this section being to show the jurisdiction of the public-service commissions with reference to general safety, investigations, and reports of accidents in the operation of gas and electric utilities.]

ARIZONA.

SEC. 42. The commission shall have power, after a hearing had upon its own motion or upon complaint, by general or special orders, rules, or regulations, or otherwise, to require every public-service corporation to maintain and operate its line, plant, system, equipment, apparatus, tracks, and premises in such manner as to promote and safeguard the health and safety of its employees, passengers, customers, and the public, and to this end to prescribe, among other things, the installation, use, maintenance and operation of appropriate safety or other devices or appliances, including interlocking and other protective devices at grade crossings or junctions and block or other systems of signaling, to establish uniform or other standards of equipment, and to require the performance of any other act which the health or safety of its employees, passengers, customers, or the public may demand.

SEC. 44. The commission shall investigate the cause of all accidents occurring within this State upon the property of any public-service corporation or directly or indirectly arising from or connected with its maintenance or operation, resulting in loss of life or injury to persons or property and requiring, in the judgment of the commission, investigation by it, and shall have the power to make such order or recommendation with respect thereto as in its judgment may seem just and reasonable; provided, that neither the order or recommendation of the commission nor any accident report filed with the commission shall be admitted as evidence in any action for damage based on or arising out of the loss of life, or injury to person or property, in this section referred to. Every public-service corporation is hereby required to file with the commission, under such rules and regulations as the commission may prescribe, a report of each accident so occurring of such kinds or classes as the commission may from time to time designate.

ARKANSAS.

SEC. 6. *Adequate facilities; safety appliances.*—Every person, firm, or corporation engaged in a public-service business in this State shall establish and maintain adequate and suitable facilities, safety appliances, or other suitable devices, and shall perform such service in respect thereto as shall be reasonable, safe, and sufficient for the security and convenience of the public, and the safety and comfort of its employees, and in all respects just and fair, and without any unjust discrimination or preferences * * *.

SEC. 8. * * * The commission shall have power, through its members, inspectors, or employees, to enter into, upon, and to inspect the property of any public utility so far as may be proper, in order to exercise the jurisdiction conferred upon the commission in this act, and shall have the power, either as a commission or by any of its members, to subpoena witnesses and take testimony and administer oaths to any witness in any proceeding or examination instituted before it or conducted by it in reference to any matter within its jurisdiction. * * *

CALIFORNIA.

(The sections of the Arizona and California laws relating to accidents appear to be the same.)

COLORADO.

SEC. 29. The commission shall have power, after a hearing had upon its own motion or upon complaint, to make general or special orders, rules, or regulations, or otherwise to require every public utility to maintain and operate its line, plant, system, equipment, apparatus, tracks, and premises in such manner as to promote and safeguard the health and safety of its employees, passengers, customers, and the public, and to require the performance of any other act which the health or safety of its employees, passengers, customers, or the public may demand. The commission shall have power to determine, order, and prescribe in accordance with the plans and specifications to be approved by it the just and reasonable manner including the particular point of crossing at which the tracks or other facilities of any public service company may be constructed across the tracks or other facilities of any other public service company at grade, or above or below grade, or at the same or different levels. * * *

CONNECTICUT.

PAR. 13. *Duties relative to safety of public and employees.*—The commission shall, so far as is practicable, keep fully informed as to the condition of the plant, equipment, and manner of operation of all public service companies, in so far as the safety of the public and of the employees of such companies may be involved, and may order such reasonable repairs or alterations in such plant or equipment, or such changes in the manner of operation, as may be reasonably necessary for public safety or for the health or safety of said employees.

PAR. 14.—*Complaints as to dangerous conditions.*—Any person or any town, city, or borough may make complaint, in writing, to the commission, of any defects in any portion of the plant or equipment of any public service company, or of the manner of operating such plant, by reason of which the public safety or the health or safety of employees is endangered; and, if he or it so requests, the name of the complainant shall not be divulged unless in the opinion of the commission the complaint is such that publicity is demanded.

PAR. 17. *Companies to report accidents.*—Every public service company shall, in the event of any accident, attended with personal injury or involving public safety, which was or may have been connected with or due to the operation of its plant or equipment, or caused by contact with its wires, notify the commission thereof, by telephone or otherwise, as soon as may be reasonably possible after the occurrence of such accident. If said notice be given otherwise than in writing it shall be confirmed in writing within five days after the occurrence of such accident. Any company failing to comply with the provisions of this section shall be fined not more than \$500 for each offense.

PAR. 18. *Duties of commission as to accidents.*—The commission shall examine into the causes of, and the circumstances connected with, all fatal accidents occurring in the operation of the plant or equipment of any public service company, and such other accidents, whether resulting in personal injury or not, as in its judgment, shall require investigation. The commission shall make a record of the causes, facts, and circumstances of each accident, within one month thereafter, and as a part of said record shall suggest means, if possible, whereby similar accidents may be avoided in the future. Such record shall be open to public inspection at the office of the commission and a copy thereof shall be mailed to the company affected thereby.

DISTRICT OF COLUMBIA.

PAR. 89. That every public utility shall, whenever an accident attended with loss of human life or personal injury without loss of human life occurs within the District of Columbia, upon its premises, or directly or indirectly arising from or connected with its maintenance or operation, give immediate notice thereof to the commission. In the event of any such accident, the commission, if it deem the public interest requires it, shall cause an investigation to be made forthwith.

IDAHO.

SEC. 42. The commission shall investigate the cause of all accidents occurring within this State upon the property of any public utility or directly or indirectly arising from or connected with its maintenance or operation, resulting in loss of life or injury to person or property and requiring in the judgment of the commission, investigation by it, and shall have the power to make such order or recommendation with respect thereto as in its judgment may seem just and reasonable: *Provided*, That neither the order or recommendation of the commission, nor any accident reported filled with the commission, shall be admitted as evidence in any action for damages based on or arising out of the loss of life or injury to person or property in this section referred to. Every public utility is hereby required to file with the commission, under such rules and regulations as the commission may prescribe, a report of each accident so occurring of such kinds or classes as the commission may from time to time designate.

ILLINOIS.

SEC. 56. *Report and investigation of accidents.*—Every public utility shall file with the commission, under such rules and regulations as the commission may prescribe, a report of every accident occurring, or that may occur, to or on its plant, equipment, or other property of such a nature as to endanger the safety, health or property of any person: *Provided*, That whenever any accident occasions the loss of life or limb to any person, such public utility shall immediately give notice to the commission of the fact by the speediest means of communication, whether telephone, telegraph or post.

The commission shall investigate all accidents occurring within this State upon the property of any public utility or directly or indirectly arising from or connected with its maintenance or operation, resulting in loss of life or injury to person or property and requiring in the judgment of the commission, investigation by it, and shall have the power to make such order or recommendation with respect thereto as in its judgment may seem just and reasonable; provided, that, neither the order or recommendation of the commission nor any accident report filed with the commission shall be admitted in evidence in any action for damages based on or arising out of the loss of life, or injury to person or property in this section referred to.

INDIANA.

SEC. 123. *Loss of life—notice given.*—Every public utility shall, whenever an accident attended with loss of human life occurs within this State upon its premises, or directly or indirectly arising from or connected with its maintenance or operation, give immediate notice thereof to the commission. In the event of any such accident, the commission, if it deem the public interest require it, shall cause an investigation to be made forthwith, which investigation shall be held in the locality of the accident, unless, for greater convenience of those concerned, it shall order such investigation to be held at some other place; and said investigation may be adjourned from place to place as may be found necessary and convenient. The commission shall give due notice to the public utility of the time and place of the investigation.

KANSAS.

SEC. 32. Every common carrier and every public utility governed by the provisions of this act shall, whenever an accident attended with loss of human life or serious personal injury occurs upon its premises within this State, give immediate notice thereof by telegraph to the commission. In the event of any such accident, the commission, if it deem the public interest requires it, shall cause an investigation to be made forthwith, in connection with the labor commission, as now provided by law, which investigation shall be held in the locality of the accident, unless for greater convenience of those concerned it shall order such investigation to be held at some other place. Said investigation may be adjourned from place to place as may be found necessary and convenient. The commission shall seasonably notify an officer or agent of the public utility or common carrier of the time and place of the investigation.

MAINE.

SEC. 33. *Investigation of accidents.*—In the event of an accident resulting in the loss of human life occurring upon the premises of any public utility, or directly or indirectly arising from or connected with its maintenance or operation, the commission shall cause an investigation thereof to be made forthwith, and in the event of any such accident resulting in personal injury or damage to property the commission may make such investigation if in its judgment the public interest requires it, which investigation shall be held in the locality of the accident, unless for the greater convenience of those concerned it shall order such investigation to be held at some other place; such investigation may adjourn from place to place as may be found necessary and convenient. The commission shall seasonably notify the public utility of the time and place of the investigation, and such public utility may then be heard; and the commission shall have power to make such order or recommendation with respect thereto as in its judgment may seem just and reasonable. Every public utility is hereby required to file with the commission under such rules and regulations as the commission may prescribe, reports of accidents so occurring, in the manner and form designated by the commission: *Provided, however,* That in case of accidents resulting in loss of human life, such report shall be made immediately by telephone or telegraph followed by a detailed written report: *Provided,* That neither the order nor recommendation of the commission nor any accident report filed with the commission shall be admitted as evidence in any action for damages based on or arising out of the loss of life or injury to person or property in this section referred to. Section 65 of chapter 52 of the Revised Statutes is hereby repealed.

MASSACHUSETTS.

SEC. 164. Corporations, persons, and municipalities engaged in the manufacture and sale of gas or electricity shall, within twenty-four hours after every accident caused by the gas or electricity manufactured or supplied by them whereby an employee or other person is injured, rendered insensible, or killed, report in writing to the board, stating the time, place, and circumstances of the accident and such other facts relative thereto as the board may require. The chief of police of the city or town, and the medical examiner of the district in which such accident occurs shall, in writing, report the same to said board. The chief of police shall so report within twenty-four hours, and the medical examiner within seven days, after he has notice thereof. The members of the board shall personally investigate all cases which require investigation.

MISSOURI.

SEC. 116. *Powers of commission to require equipment or performance of acts which the health or safety of its employees or the public may demand.*—The commission shall have power, after a hearing had upon its own motion or upon complaint, by general or special orders, rules, or regulations, or otherwise, to require every person, corporation, and public utility to maintain and operate its line, plant, system, equipment, apparatus, tracks, and premises in such manner as to promote and safeguard the health and safety of its employees, passengers, customers and the public, and to this end to prescribe, among other things, the installation, use, maintenance, and operation of appropriate safety and other devices or appliances, including interlocking and other protective devices at grade crossings or junctions and block and other systems of signaling, to establish uniform or other standards of equipment, and to require the performance of any other act which the health or safety of its employees, passengers, customers, or the public may demand.

MONTANA.

SEC. 27. The commission or some member thereof or some person deputed by it shall investigate and make inquiry into every accident occurring in the operation of

any public utility in this State resulting in death or injury to any person of such gravity as to require the attention of a physician or surgeon. The testimony taken at such hearing shall be transcribed and filed in the office of the commission.

(a) It is hereby made the duty of every public utility operating within this State, promptly upon the occurrence of any accident, such as is mentioned above, to report by telegraph, followed by written report, the same to the commission, in which report shall be stated the time and place of accident, the names of persons killed or injured, and in concise form the nature and cause of such accident. The commission shall prescribe forms for the purpose of making such written reports. Reports of accidents as referred to in this section shall be included in the commission's annual report to the governor.

NEVADA.

SEC. 27. *Notice of serious accidents to persons given commission.*—Every public utility shall, whenever an accident occurs in the conduct of its operation, causing death or personal injuries, give immediate notice thereof to the commission. If in its judgment the public interest requires it, the commission shall cause an investigation to be made forthwith, at such place and in such manner as the commission shall deem best.

NEW HAMPSHIRE.

SEC. 15. The commission shall investigate the causes of all accidents happening upon the railroads of the State resulting in the loss of life and of all other accidents so happening which, in the opinion of the commission, ought to be investigated. Any such investigation may be made by the full commission or by a single commissioner, as the commission may determine. If such investigation is made by a single commissioner, said commissioner for the purpose of the particular investigation shall have and exercise all the powers of the full commission.

NEW JERSEY.

SEC. 17. The board shall have power after hearing upon notice by order in writing to require every public utility as herein defined:

(g) To give such notice to the board as the board may by rule require of any and all accidents which may occur within this State upon the property of any public utility as herein defined or directly or indirectly arising from or connected with its maintenance or operation, and to investigate any such accident and to make such order or recommendation with respect thereto as in its judgment may be just and reasonable.

NEW YORK.

SEC. 66. *General powers of commission in respect to gas and electricity.*—Each commission shall within its jurisdiction: (2) Investigate and ascertain, from time to time, the quality of gas supplied by persons, corporations, and municipalities; examine or investigate the methods employed by such persons, corporations, and municipalities in manufacturing, distributing, and supplying gas or electricity for light, heat, or power and in transmitting the same; have power to order such reasonable improvements as will best promote the public interest, preserve the public health, and protect those using gas or electricity and those employed in the manufacture and distribution thereof; and have power to order reasonable improvements and extensions of the works, wires, poles, lines, conduits, ducts, and other reasonable devices, apparatus, and property of gas corporations, electrical corporations, and municipalities.

NORTH CAROLINA.

SEC. 7. It is the intention of this act to give the said corporation commission the same control, power, and supervision over such persons, companies, and corporations named in this act as it has over railroad corporations in this State.

OKLAHOMA.

SEC. 2. The commission shall have general supervision over all public utilities, with power to fix and establish rates and to prescribe rules, requirements, and regulations affecting their services, operation, and the management and conduct of their business; shall inquire into the management of the business thereof and the method in which same is conducted. It shall have full visitatorial and inquisitorial power to examine such public utilities and keep informed as to their general conditions, their capitalization, rates, plants, equipments, apparatus, and other property owned, leased, controlled, or operated, the value of the same, the management, conduct, operation, practices, and services not only with respect to the adequacy, security, and accommodation afforded by their service but also with respect to their compliance with the provisions of this act, and with the constitution and laws of this State, and with the orders of the commission.

OREGON.

552. *Investigation of accidents.*—Every public utility shall, whenever an accident attended with loss of human life occurs within this State upon its premises, or directly or indirectly arises from or connected with its maintenance or operation, give immediate notice thereof to the commission. In the event of any such accident the commission, if it deem the public interest require it, shall cause an investigation to be made forthwith, which investigation shall be held in the locality of the accident unless for greater convenience of those concerned it shall order such investigation to be held at some other place; and said investigation may be adjourned from place to place as may be found necessary and convenient. The commission shall seasonably notify the public utility of the time and place of the investigation.

PENNSYLVANIA.

ART. II, SEC. 1. (x) To give immediate notice to said commission of the happening of any accident in or about, or in connection with the operation of its property, facilities or service, wherein any person shall have been killed or injured; and to furnish such full and detailed report of such accident, within such time and in such manner as the commission shall, by general rule or special order, or otherwise, require. Such report shall not be open for public inspection, except by order of the commission, and shall not be admitted in evidence for any purpose in any suit or action for damages growing out of any matter or thing mentioned in said report.

RHODE ISLAND.

SEC. 23. *Public safety.*—If upon such a hearing and investigation the commission shall find that the regulations, practices, acts, plant or equipment, appliances, or service of any public utility, or any condition suffered, permitted, or maintained by any public utility, is unsafe or improper, or that the public safety is endangered thereby, the commission shall by order determine the proper regulations, practices, acts, plant or equipment, appliances or service thereafter to be in force and to be observed, maintained, and used by such public utility, and may by order require any dangerous or unsafe condition to be removed or remedied.

SEC. 49. Every public utility shall, whenever any accident attended with loss of human life or serious injury occurs within this State, directly or indirectly arising from or connected with its maintenance or operation, give immediate notice thereof to the commission. In the event of any such accident, the commission, if it deem that public interest requires it, shall cause an investigation to be made forthwith, which investigation shall be held in the locality of the accident, unless for the greater convenience of those concerned it shall order the investigation to be held at some other place; and said investigation may be adjourned from place to place as may be found necessary and convenient. The commission shall seasonably notify the public utility of the time and place of the investigation. The notice herein required to be given shall not be admitted as evidence or used for any purpose against such public utility giving such notice in any suit, action, or proceeding brought for damages

growing out of any matter mentioned in said notice, nor shall such notice be admitted as evidence or be used for any purpose in any criminal proceeding brought against the public utility giving such notice, or against any of its officers, agents, or employees, growing out of any matter mentioned in such notice.

VERMONT.

SEC. 7. The superintendent or manager of any line or plant subject to supervision under this act shall immediately after its occurrence notify said commission in writing of any accident within this State upon such line or plant resulting in loss of life or injury to any person which shall incapacitate him from engaging in his usual vocations. Said commission shall inquire into the cause of every such accident, and if in its judgment a public investigation is necessary, it shall fix a time and place of holding the same, and thereupon proceed as provided in section 4609 of the Public Statutes relating to investigation of accidents upon railroads.

WASHINGTON.

SEC. 26 [last par.]. Every gas company, electrical company, and water company shall construct and maintain such facilities in connection with the manufacture and distribution of its product as will be efficient and safe to its employees and the public.

SEC. 63. *Investigation of wrecks.*—Every public service company is hereby required to give immediate notice to the commission of every accident resulting in death or injury to any person occurring on its lines, plant, or system in such manner as the commission may prescribe. The commission may require reports to be made by any common carrier of all wrecks, collisions, or derailments occurring on the line of any such common carrier. Such notice shall not be admitted as evidence or used for any purpose against such public service company giving such notice in any suit or action for damages growing out of any matter mentioned in such notice.

The commission is hereby authorized and directed to investigate all accidents that may occur upon the lines of any common carrier resulting in loss of life to any passenger or employee, and may investigate any and all accidents or wrecks occurring on the line of any such common carrier or any accident resulting in death or injury to any person occurring in connection with the plant or system of any public service company. Notice of such investigation shall be given in all cases for a sufficient length of time to enable the public service company affected to participate in the hearing, and such notice may be given orally or in writing, in such manner as the commission may prescribe.

Such witnesses may be examined as the commission may deem necessary and proper to thoroughly ascertain the cause of the accident or wreck and fix the responsibility therefor. Such examination and investigation may be conducted by the inspector or any deputy inspector, and such inspector or deputy inspector shall have the power to administer oaths, issue subpoenas, and compel the attendance of witnesses, and when such examination is conducted by the inspector or deputy inspector he shall make a full and complete report thereof to the commission.

WISCONSIN.

SEC. 1797m—101. 1. Every public utility shall, whenever an accident attended with loss of human life occurs within this State upon its premises or directly or indirectly arising from or connected with its maintenance or operation, give immediate notice thereof to the commission.

2. In the event of any such accident the commission, if it deem public interest require, shall cause an investigation to be made forthwith, which investigation shall be held in the locality of the accident, unless for greater convenience of those concerned it shall order such investigation to be held at some other place; and said investigation may be adjourned from place to place as may be found necessary and convenient. The commission shall seasonably notify the public utility of the time and place of the investigation.

APPENDIX 2.—TABLES OF SERVICE REQUIREMENTS, TEST RESULTS, AND CENTRAL STATION STATISTICS.

TABLE 1.—Watthour Meter Errors Allowed in Statutes and by Commission Regulations.

State.	Allowable error.	Rule.	Page.
Arizona.....	3 per cent, Laws 1912, Special session, chap. 52, sec. 7.....	.....	292
California.....	3 per cent on light load, half load, or full load.....	13	53
	2 per cent under ordinary conditions of normal operation.....	.....	.....
Colorado.....	3 per cent, average error.....	40	181
	+2 or -3 per cent at light load.....	35	53
	±2 per cent at heavy load.....	35	53
	4 per cent, public acts, 1911, chap. 128, sec. 20.....	.....	295
Connecticut.....	2 per cent, average error for installation.....	E15	54
	2 per cent, not in excess of, at heavy load—installation.....	E15	54
	4 per cent, not in excess of, at light load—installation.....	E15	54
	4 per cent on commission test.....	5	191
	4 per cent, Public No. 435, H. R. 28499, par. 57.....	.....	296
District of Columbia.....	4 per cent on commission test.....	10	175
	1 per cent, adjustment light and heavy load.....	28	54
	4 per cent, average error.....	17	182
Illinois.....	2 per cent, adjustment, average.....	10	54
	1 per cent, heavy load.....	10	54
	4 per cent (3 per cent induction type) light load.....	10	54
	4 per cent, average error.....	13e	56
Indiana.....	±2 per cent, average adjustment.....	13b	56
	±1 per cent, heavy load.....	13b	56
	±4 per cent, light load.....	13b	56
	4 per cent, Laws 1910, chap. 180, sec. 32.....	.....	301
Maryland.....	4 per cent on commission test, average error.....	4b	56
	1 per cent, adjustment.....	4b	56
	2 per cent, in service.....	4c	56
Massachusetts.....	5 per cent, Acts 1914, chap. 742, sec. 190.....	.....	302
	4 per cent, average error.....	38	183
Michigan.....	±2 per cent, average adjustment.....	26	57
	±1 per cent, heavy load.....	26	57
	±3 per cent, light load.....	26	57
Missouri.....	4 per cent, Laws 1913, Public Service Commission law, sec. 71(5).....	.....	304
	4 per cent, at any load.....	31	57
	4 per cent, average error.....	26	184
Montana.....	2 per cent, average adjustment.....	22	58
	1 per cent, heavy load.....	22	58
	4 per cent, light load.....	22	58
Nevada.....	2 per cent on normal load.....	15	58
	3 per cent on one-tenth rated meter capacity.....	15	58
New Hampshire.....	4 per cent on light, normal, or heavy load.....	2	58
New Jersey.....	4 per cent on light load or heavy load.....	18	58
New York.....	1 per cent, adjustment, light and full load.....	22	59
	4 per cent, Laws 1910, chap. 480, sec. 67(5).....	.....	309
North Carolina.....	2½ per cent, Act Feb. 15, 1909.....	.....	309
	±4 per cent, average error.....	13	59
North Dakota.....	±2 per cent, average initial adjustment.....	13	59
	±1 per cent, heavy load.....	13	59
	±4 per cent, light load.....	13	59
	3 per cent, average error.....	36	185
Oklahoma.....	2 per cent, average adjustment.....	13b	60
	+2 or -4 per cent, light load adjustment.....	13b	60
	±2 per cent, heavy load adjustment.....	13b	60
Oregon.....	4 per cent.....	5b	180
Pennsylvania.....	4 per cent, average at light and heavy load.....	11, 12	61
Rhode Island.....	2 per cent, Public Laws, 1912, chap. 795, sec. 47.....	.....	313
	±4 per cent, average.....	15d	62
	±2 per cent, average, initial adjustment.....	15b	62
South Carolina.....	±1 per cent, heavy load.....	15b	62
	±4 per cent, light load.....	15b	62
Washington.....	4 per cent, Laws, 1911, chap. 117, sec. 74.....	.....	317
	4 per cent on one-tenth or full load.....	27	62
West Virginia.....	2 per cent, Acts 1913, Public Service Commission law, sec. 10.....	.....	318
	2 per cent at light load or heavy load.....	11	62
Wisconsin.....	4 per cent, between one-tenth and full connected load.....	15	63

TABLE 2.—Maximum Watthour Meter Errors Allowed by City Ordinances.

City.	Allowable error.	City.	Allowable error.
	Per cent.		Per cent.
Birmingham, Ala.	4	Minneapolis, Minn.	2.5
Charleston, S. C.	4	Memphis, Tenn.	3
Chicago, Ill.	4	Norfolk, Va.	4
Cincinnati, Ohio.	5	Sandusky, Ohio.	3
Dallas, Tex.	2.5	San Francisco, Calif.	2
Kansas City, Mo.	4	Sioux City, Iowa.	2
Louisville, Ky.		Topeka, Kans.	3

TABLE 3.—Summary of Results of Periodic Meter Tests by Owning Companies as Reported to New York Public Service Commission, Second District.

Year.	Meters tested.	More than 4 per cent fast.		More than 4 per cent slow.		Between 4 per cent fast and 4 per cent slow.		Reference.
		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	
1909.....	78,116	7,458	9.5	16,085	20.6	54,573	69.9	Report 1909, vol. 1, p. 46.
1910.....	84,576	6,247	7.4	14,742	17.4	63,578	75.2	Report 1910, vol. 1, p. 34.
1911.....	87,893	4,947	5.6	12,791	14.6	70,155	79.8	Report 1911, vol. 1, p. 37.
1912.....	97,446	4,694	4.8	11,621	12.0	81,131	83.2	Report 1912, vol. 1, p. 19.
1913.....	104,886					91,176	87.0	Report 1913, vol. 1, p. 88.
1914.....	122,921	3,581	2.9	10,040	8.2	109,300	88.9	Report 1914, vol. 1, p. 21.
1915.....	128,896	3,408	2.6	9,021	7.0	116,467	90.4	Report 1915, vol. 1, p. 66.
1916.....	137,484	4,241	3.1	7,851	5.7	125,392	91.2	Report 1916, vol. 1, p. 74.
1917.....	129,774	4,213	3.2	7,150	5.5	118,411	91.2	Report 1917, vol. 1, p. 68.
1918.....	96,404	3,622	3.7	6,352	6.6	85,430	89.6	Report 1918, vol. 1, p. 87.
1919.....	132,756	4,550	3.4	7,731	5.8	120,475	90.7	Report 1919, vol. 1, p. 89.
1920.....	141,163	5,369	3.8	8,227	5.8	127,567	90.3	Report 1920, vol. 1, p. 73.

TABLE 4.—Summary of Results of Meter Tests on Complaint of Customer, Reported by New York Public Service Commission, First District (Tests Made by the Commission).

Year.	Meters tested.	Found creeping.		More than 4 per cent fast.		More than 4 per cent slow.		Between 4 per cent fast and 4 per cent slow.	
		Num-ber.	Per cent.	Num-ber.	Per cent.	Num-ber.	Per cent.	Num-ber.	Per cent.
1908.....	239	.....	.....	32	13.5	28	11.5	179	75.0
1909.....	925	56	6.1	67	7.2	91	9.8	767	82.9
1910.....	637	43	6.7	36	5.7	47	7.4	554	86.9
1911.....	609	26	4.3	33	5.4	28	4.6	548	90.0
1912.....	651	29	4.4	54	8.3	21	3.2	576	88.5
1913.....	568	38	6.7	42	7.4	17	3.1	509	89.5
1914.....	701	53	7.6	24	3.3	17	2.5	660	94.2
1915.....	661	63	9.5	49	7.4	14	2.1	598	90.4
1916.....	478	21	4.3	17	3.5	4	0.8	457	95.6
1917.....	268	10	3.7	7	2.6	12	4.4	249	92.9
1918.....	147	3	2.0	9	6.1	2	1.3	136	92.5
1919.....	242	2	0.8	13	0.6	4	0.15	225	99.3

TABLE 5.—Summary of Results of Commission Tests of Company Standards (New York, Second District).

Year.	Rotating stand-ards tested.	Volt-meters, amme-ters, watt-meters.	Master watt-hour meters.	Approved, accurate.		Disapproved, inaccurate.		Inaccurate, adjusted by inspectors.	
				Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
1918.....	486	116	132	681	92.4	13	1.8	40	5.5
1919.....	454	49	86	545	92.5	19	3.3	25	4.2
1920.....	259	35	13	272	88.6	20	6.5	15	4.9

TABLE 6.—Estimated Percentage of Meters of Various Sizes in Use.

Meters.	Per cent.
5-ampere.....	80.0
10-ampere.....	12.0
15-25 ampere.....	6.0
50-75 ampere.....	1.7
100 amperes and above.....	0.3
	100.0

TABLE 7.—Summary of Tests of Watthour Meters Made by Operating Company as Required by Rules of the Public Utilities Commission, District of Columbia.

Year.	Meters tested.	Meters found creeping.		More than 4 per cent fast.		More than 4 per cent slow.	
		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
1915.....	19,156	90	0.47	556	2.9	1,899	9.9
1916.....	16,273	128	.79	396	2.4	1,402	8.6
1917.....	14,768	73	.49	245	1.7	1,231	8.4
1918.....	11,966	75	.63	186	1.5	766	6.4
1919.....	18,959	167	.88	402	2.1	1,679	8.8

Year.	Meters tested.	Light load.		Heavy load.	
		Between 4 per cent fast and 4 per cent slow.		Between 4 per cent fast and 4 per cent slow.	
		Number.	Per cent.	Number.	Per cent.
1915.....	19,156	16,701	87.2	18,594	97.1
1916.....	16,273	14,475	89.0	15,779	97.0
1917.....	14,768	13,292	89.9	14,233	96.4
1918.....	11,966	11,014	92.1	11,630	97.2
1919.....	18,959	16,878	89.1	18,137	95.7

TABLE 8.—Summary of Tests of Watthour Meters Made Under the Supervision of the Public Utilities Commission of the District of Columbia.

Years.	Meters tested.	Found creeping.		More than 4 per cent fast.		More than 4 per cent slow.		Between 4 per cent fast and 4 per cent slow.	
		Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
1914.....	27	2	7.4	1	3.7	2	7.4	24	88.9
1915.....	58	3	5.2	3	5.2	2	3.4	53	91.4
1916.....	44	5	11.4	3	6.8	4	9.1	37	84.1
1917.....	37	2	5.4	5	13.5	2	5.4	30	81.1
1918.....	47	5	10.6	3	6.4	1	2.1	43	91.5
1919.....	24	0	0.0	1	4.2	1	4.2	22	91.6
1920.....	55	.....	.....	1	1.8	3	5.5	51	92.7
1921.....	81	.....	.....	8	10.0	5	6.2	68	83.7

TABLE 9.—Intervals in Months for the Periodic Testing of Meter as Required by Commission Rules.
[Periods are given in months. Starred periods (*) are for meters as per requirements of Meter Code, types being mentioned in the State rules.]

State.	Commutator and mercury types.			Single-phase 2 and 3 wire induction types.		Polyphase self-contained types.		Polyphase types with instrument transformers.
	Amperes.			Amperes.		Kilovolt-amperes.		
	50 and under.	50 to 500.	Over 500.	25 and under.	Over 25.	50 and under.	Over 50.	
Arizona ¹								
Colorado.....	{ (15 and less)	{ (15 to 500)	12	36	24	24	12	{ (2)
Connecticut.....	18	12		36	24	18	12	24
District of Columbia.....	18	{ (50 to 150)	{ (Over 150)	36	24	24	12	{ (2)
Illinois.....	18	12		30 or 48*	24	24	12	24
Indiana.....	18	12		36	24	18	12	24
Iowa.....	18	12		36	36	36	36	36
Maryland.....	18	18	18	36	24	{ (150 and under)	{ (Over 150)	{ (2)
Michigan.....	18	12		36	24	24	12	{ (2)
Montana.....	{ (25 and under)	{ (Over 25)		36	24	18	12	24
Missouri.....	12	6	6	{ (50 and under)	{ (Over 50)	{ (4)	{ (4)	{ (4)
Nevada ²	12	12	12	{ (30 and under)	{ (Over 50)	{ (25 and under)	{ (Over 25)	{ (2)
New Hampshire.....								
New Jersey.....	{ (25 and under)	{ (25 to 500)	6	30	24	{ (150 and under)	{ (Over 150)	{ (2)
New York.....	{ (25 and under)	{ (200)	{ (Over 400)			{ (150 and under)	{ (Over 150)	{ (2)
North Dakota.....	18	12		42	24	{ (150 and under)	{ (Over 150)	{ (2)
Oklahoma.....	18 (d. c. 24)	12 (d. c. 18)		36	24	24	12	24
Oregon.....	12	6	{ (d. c. 6)	30 or 48*	24	24	12	18
Pennsylvania.....	18	12	6	{ (50 and under)	{ (Over 50)	12	6	
South Carolina.....	18	12	12	36	24	18	12	24
Texas.....	18	12	12	36 (prior to 1907-30)	24	18	12	18
Washington ³				36	24	18	12	24
West Virginia.....	{ (25 and under)	{ (Over 25)	6	36	24	24	12	{ (2)
Wisconsin.....	12	6	6	24 or 48*	12	12	6	

¹ Each service meter shall be tested at least once in two years.

² Same as for self-contained types.

³ Single and polyphase meters over 100 kw. on 2,000 volts and over 6 months.

⁴ Same as for single-phase meters.

⁵ Each electric meter shall be tested at least once a year.

⁶ Single and polyphase meters up to 100 kw. on 2,000 volts and over 12 months.

⁷ No meter shall be in service longer than 3 years without being tested.

TABLE 10.—Voltage Regulation Requirements in Commission Rules.

State.	Circuit or contract.	Per cent variation from standard.	Period.	Time.	Rule.
Colorado	Lighting. In towns of 2,500 and over.	Within 5 per cent plus or minus. Total variation not to exceed 7 per cent minimum to maximum.	Minutes.	Between 6 and 11 p. m.	31
	In all other places.	Total variation not to exceed 9 per cent minimum to maximum.		do.	do.
Connecticut	Power.	Shall not exceed 10 per cent above or below.		When service is furnished.	do.
	Lighting.	5 per cent above, 3 per cent below.	1	Sunset and 11 p. m.	16
	Power.	10 per cent above or below.	1	Any time.	16
	Lighting.	10 per cent from standard.		During lighting hours.	15
District of Columbia	Power.	10 per cent from standard.		Other hours.	do.
Illinois	Lighting contract.	Shall not exceed 5 per cent above or 4 per cent below.	1	Between sunset and 11 p. m.	18
	do.	10 per cent above or below.		At other times.	do.
Indiana	Power contract.	Shall not exceed 10 per cent above or below.	1	Between sunset and 11 p. m.	26
	Lighting.	Within 5 per cent plus or minus.		do.	23
Michigan	In places having more than 2,500 population.	Total variation not to exceed 6 per cent minimum to maximum.		do.	do.
	In all other places.	Total variation not to exceed 8 per cent minimum to maximum.		do.	do.
Maryland	Power.	Not to exceed 10 per cent above or below.		At any time.	2
	Power and at other than lighting hours.	6 per cent above and below.		Sunset and 11 p. m.	do.
Missouri	Lighting (in places having more than 2,000 population).	5 per cent above and 3 per cent below.		Between sunset and 12 midnight.	49
	In all other places.	7 per cent above and 5 per cent below.	1	do.	do.
Montana	Power.	3 per cent above, 5 per cent below.	1	Sunset and 11 p. m.	27
	Lighting.	15 per cent above, 10 per cent below.	1	Between 11 p. m. and following sunset.	do.
Nevada	Power.	Within 6 per cent plus or minus.	1	Sunset and 11 p. m.	5
	Lighting.	Total variation not to exceed 7 per cent minimum to maximum.		do.	do.
New Hampshire	In all other places.	Total variation not to exceed 8 per cent minimum to maximum.		At any time.	23
	Power.	Not more than 6 per cent of the minimum.		During lighting hours.	14
North Dakota	Power.	Within 10 per cent.		do.	14
	Lighting.	Maximum not more than 10 per cent above minimum.		do.	do.
North Dakota	do.	Within 5 per cent plus or minus.		Between sunset and 11 p. m.	23
	In towns and cities over 2,500.	Total variation not to exceed 10 per cent minimum to maximum.		do.	do.
Ohio	Power.	Not to exceed 8 per cent.		At any time.	do.
	Lighting.	Not to exceed 10 per cent.		do.	do.

			5	6
New Jersey.....	On constant-potential system.....	Not more than 3 per cent above nor 3 per cent below standard.	5	6
Oklahoma.....	Lighting.....	Within 5 per cent plus or minus.....	.....	26
	In incorporated towns of 2,500.....	Total variation not to exceed 6 per cent minimum to maximum.	.....	.....
	In all other places.....	Total variation not to exceed 8 per cent minimum to maximum.	.....	.....
Oregon ¹	Power.....	Not to exceed 10 per cent above or below.....	5	25
	Lighting.....	3 per cent above, 5 per cent below.....	5	.....
	do.....	5 per cent above, 10 per cent below.....	.....	.....
Pennsylvania.....	Other circuits.....	10 per cent above or below.....	5	2
	Lighting contract.....	5 per cent plus or minus.....	1	.....
	Power contract.....	10 per cent plus or minus.....	1	.....
South Carolina.....	Lighting.....	Not to exceed 6 per cent above or below.....	.....	20
	Power.....	Not to exceed 10 per cent above or below.....	.....	20
West Virginia.....	Lighting.....	5 per cent above, 3 per cent below.....	1	24
	Both lighting and power.....	10 per cent either way.....	1	.....
Wisconsin.....	Lighting.....	Within 3 per cent of standard.....	.....	25
	do.....	Within 10 per cent.....	.....	.....
	Power.....	do.....	.....	.....
	Service in towns of less than 1,500 people.....	Maximum shall not be more than 6 per cent above minimum.	.....	.....

¹ Applicable to utilities selling more than 50,000 kilowatt-hours annually or having more than 50 consumers.

² Applicable to all other utilities.

³ Applicable only in towns of more than 1,500 population.

TABLE 11.—Comparative Summary of Commercial and Municipal Plants, 1917.

[From Census of Electric Industries, 1917—Central Electric Light and Power Station.]

	Total.	Commercial.	Municipal.	Per cent of total.	
				Commer- cial.	Municipal.
Number of plants.....	6,542	4,224	2,318	64.6	35.4
Generating all or part of current.....	5,124	3,347	1,777	65.3	34.7
Purchasing all current.....	1,418	877	541	61.8	38.2
Number of separate generating stations.....	5,952	4,116	1,836	69.2	30.8
Number of cities, towns, etc., served by all stations.....	13,716	11,349	2,367	82.7	17.3
Population of districts served with current.....	1 62,919,662	56,459,723	13,671,460	80.5	19.5
Value of plant and equipment.....	\$3,060,392,141	\$2,933,016,941	\$127,375,200	95.8	4.2
Total income.....	\$526,894,240	\$486,634,021	\$40,260,219	92.4	7.6
Sale of current for light, heat, and power, including free service.....	\$502,059,980	\$462,473,917	\$39,586,063	92.1	7.9
All other sources.....	\$24,834,260	\$24,160,104	\$674,156	97.3	2.7
Total expenses, including salaries and wages ²	\$426,568,307	\$395,127,395	\$31,440,912	92.6	7.4
Total number of persons employed.....	105,541	94,679	10,862	89.7	10.3
Prime movers:					
Number of units.....	13,795	10,387	3,408	75.3	24.7
Total horsepower.....	12,936,735	12,077,657	859,098	93.4	6.6
Dynamos:					
Number.....	13,428	9,991	3,437	74.4	25.6
Kilowatt capacity.....	8,994,407	8,411,944	582,463	93.5	6.5
Output of stations (total).....	31,044,049,234	29,812,190,746	1,231,858,488	96.0	4.0
Kilowatthours generated.....	25,438,303,272	24,398,993,183	1,039,320,089	95.9	4.1
Kilowatthours purchased.....	5,605,745,962	5,413,207,563	192,538,399	96.6	3.4
Kilowatthours sold (total) ³	25,751,964,800	24,722,517,379	1,029,447,421	96.0	4.0
For light.....	5,112,516,949	4,445,217,785	667,299,164	86.9	13.1
For power.....	13,174,827,277	12,833,191,106	341,636,171	97.4	2.6
To other public service corporations.....	7,464,620,574	7,444,108,488	20,512,086	99.7	0.3
Number of street lamps:					
Arc.....	256,950	208,957	49,993	80.5	19.5
Incandescent and other varieties.....	1,392,284	969,709	422,575	69.6	30.4
Stationary motors served:					
Number ⁴	555,924	504,864	51,060	90.8	9.2
Horsepower capacity.....	9,216,330	8,790,707	425,623	95.4	4.6
Number of meters.....	7,102,569	6,172,436	930,133	86.9	13.1
Number of customers.....	7,178,703	6,202,189	976,514	86.4	13.6

¹ Duplicated population eliminated.² In addition to salaries and wages, includes the cost of supplies and materials used for ordinary repairs and replacements, advertising, fuel, mechanical power, electrical energy purchased, taxes, charges for depreciation and charges for sinking fund, and all other expenses incident to operation and maintenance.³ Resales not deducted.⁴ Figures not complete for commercial plants.

TABLE 12.—Comparative Summary—Central Electric Stations and Gas Plants.

	Central electric stations.				Gas plants.		Per cent of increase. ¹					
							Central electric stations.			Gas plants.		
	1917	1912	1907	1914	1909	1904	1907-1917	1912-1917	1907-1912	1904-1914	1909-1914	1904-1909
Number of establishments.....	6,542	5,221	4,714	1,284	1,296	1,019	38.8	25.3	10.8	26.0	-0.9	27.2
Value of plant and equipment.....	\$3,060,392,141	\$2,175,678,266	\$1,096,913,622	\$1,252,421,584	\$915,536,762	\$725,035,204	179.0	40.7	78.3	72.7	36.8	26.3
Gross income.....	\$26,894,240	\$302,713,398	\$175,642,388	\$220,237,790	\$166,814,371	\$125,144,945	200.0	74.3	72.1	76.0	32.0	33.3
From sale of electric current or gas.....	\$302,039,980	\$287,136,637	\$169,614,691	\$173,065,820	\$158,018,368	\$112,082,968	198.0	74.8	69.3	55.4	26.2	23.9
From all other sources.....	\$24,854,260	\$15,134,741	\$6,027,647	\$45,171,970	\$28,159,882	\$12,062,977	322.0	64.1	151.1	261.9	60.2	123.0
Total number of persons employed.....	105,341	115,793,333	47,652	63,915	50,730	39,972	121.6	33.0	66.6	39.9	26.0	26.9

¹ A minus sign (—) denotes decrease.² Capital invested—owned and borrowed.³ Exclusive of the income reported by the electric light and power departments of electric railways, as follows: In 1917, \$54,348,875; in 1912, \$31,515,582; and in 1907, \$17,291,824.

TABLE 13.—Commercial Central Electric Stations.

	1917	1912	1907	Per cent of increase. ¹		
				1907-1917	1912-1917	1907-1912
Number of stations.....	4,224	3,659	3,462	22.0	15.4	5.7
Value of plant and equipment.....	\$2,933,016,941	\$2,098,613,122	\$1,054,034,175	178.3	39.8	99.1
Total income.....	\$486,634,021	\$279,054,409	\$161,630,339	201.1	74.4	72.6
Light, heat, and power, including free service.....	\$462,473,917	\$264,474,949	\$156,000,237	196.4	74.9	69.5
All other sources.....	\$24,160,104	\$14,579,460	\$5,630,082	329.1	65.7	159.0
Total expenses, including salaries and wages ²	\$395,127,395	\$217,660,112	\$123,880,291	219.0	81.5	75.7
Total number of persons employed....	94,679	71,395	42,066	125.1	32.6	69.7
Prime movers:						
Number.....	10,387	9,326	8,981	15.6	11.4	3.8
Total horsepower.....	12,077,657	6,970,716	3,776,837	219.8	73.3	84.6
Dynamos:						
Number.....	9,991	9,843	9,778	2.2	1.5	0.7
Kilowatt capacity.....	8,411,944	4,768,762	2,500,209	235.4	76.4	90.7
Output of stations:						
Kilowatthours generated.....	24,398,983,183	11,031,583,155	5,572,813,949	337.8	121.2	98.0
Kilowatthours purchased.....	5,413,207,563	2,524,922,228	(³)	.....	114.4	.....
Number of street lamps:						
Arc.....	206,957	264,152	(⁴)	.....	-21.7	.....
Incandescent and other varieties..	969,709	474,488	(⁴)	.....	104.4	.....
Stationary motors served:						
Number.....	504,864	413,578	162,677	210.3	22.1	154.2
Horsepower capacity.....	8,790,707	3,966,328	1,617,337	443.5	121.6	145.2
Number of customers.....	6,202,189	3,311,870	1,663,354	272.9	87.3	99.1

¹ A minus sign (—) denotes decrease.² In addition to salaries and wages, includes the cost of supplies and materials used for ordinary repairs and replacement, advertising, fuel, mechanical power, electrical energy purchased, taxes, charges for depreciation, and all other expenses incident to operation and maintenance.³ Not reported.⁴ Figures not available.

TABLE 14.—Municipal Central Electric Stations.

	1917	1912	1907	Per cent of increase. ¹		
				1907-1917	1912-1917	1907-1912
Number of stations.....	2,318	1,562	1,252	85.1	48.4	24.8
Value of plant and equipment.....	\$127,375,200	\$77,065,144	\$42,879,447	197.1	65.3	79.7
Total income.....	\$40,260,219	\$23,218,989	\$14,011,999	187.3	73.4	65.7
Light, heat, and power, including free service.....	\$39,586,063	\$22,663,708	\$13,614,434	190.8	74.7	66.5
All other sources.....	\$674,156	\$555,281	\$397,565	69.6	21.4	39.7
Total expenses, including salaries and wages ²	\$31,440,912	\$16,917,165	\$10,316,620	204.8	85.8	64.0
Total number of persons employed....	10,862	7,940	5,566	95.1	36.8	42.7
Prime movers:						
Number.....	3,408	2,576	2,017	69.0	32.3	27.7
Total horsepower.....	859,098	559,328	321,351	167.3	53.6	74.1
Steam engines and steam turbines—						
Number.....	2,200	2,024	1,786	23.2	8.7	13.3
Horsepower.....	596,871	406,666	284,922	109.5	46.8	42.7
Water wheels—						
Number.....	265	269	153	73.2	-1.5	75.8
Horsepower.....	200,395	130,261	30,347	560.3	53.8	329.2
Internal-combustion engines—						
Number.....	943	283	78	.....	233.2	.....
Horsepower.....	61,832	22,401	6,082	916.6	176.0	268.3
Dynamos:						
Number.....	3,437	2,767	2,395	43.5	24.2	15.5
Kilowatt capacity.....	582,463	396,677	209,016	178.7	46.8	89.8
Output of stations:						
Kilowatt hours generated.....	1,039,320,089	537,526,730	289,462,788	259.1	93.4	85.7
Kilowatt hours purchased.....	192,538,399	88,580,377	(³)	.....	117.4	.....
Number of street lamps:						
Arc.....	49,993	84,491	(⁴)	.....	-40.8	.....
Incandescent and other varieties..	422,575	207,469	(⁴)	.....	103.7	.....
Stationary motors served:						
Number.....	51,060	21,895	4,507	1,032.9	133.2	385.8
Horsepower capacity.....	425,623	164,291	31,689	1,243.1	159.1	418.4
Number of customers.....	976,514	525,648	283,625	244.3	85.8	85.3

¹ A minus sign (—) denotes decrease. Percentages are omitted when base is less than 100.² In addition to salaries and wages, includes cost of supplies and materials used for ordinary repairs and replacement, advertising, fuel, mechanical power, electrical energy purchased, taxes, charges for depreciation, and all other expenses incident to operation and maintenance.³ Not reported.⁴ Figures not available.

TABLE 15.—Relative Importance of Commercial and Municipal Electric Central Stations.

[All values in per cent.]

	Per cent of total, commercial and municipal stations.					
	Commercial.			Municipal.		
	1917	1912	1907	1917	1912	1907
Number of stations.....	64.6	70.1	73.4	35.4	29.9	26.6
Value of plant and equipment.....	95.8	96.5	96.1	4.2	3.5	3.9
Total income.....	92.4	92.3	92.0	7.6	7.7	8.0
Light, heat, and power, including free service.....	92.1	92.1	92.0	7.9	7.9	8.0
All other sources.....	97.3	96.3	93.4	2.7	3.7	6.6
Total expenses, including salaries and wages.....	92.6	92.8	92.3	7.4	7.2	7.7
Total number of persons employed.....	89.7	90.0	88.3	10.3	10.0	11.7
Prime movers:						
Number.....	75.3	78.4	81.7	24.7	21.6	18.3
Total horsepower.....	93.4	92.6	92.2	6.6	7.4	7.8
Steam engines and steam turbines.....	92.9	91.8	89.4	7.1	8.2	10.6
Water wheels.....	95.3	94.7	97.8	4.7	5.3	2.2
Internal-combustion engines.....	70.6	79.8	89.1	29.4	20.2	10.9
Dynamos:						
Number.....	74.4	78.1	80.3	25.6	21.9	19.7
Kilowatt capacity.....	93.5	92.3	92.3	6.5	7.7	7.7
Output of stations (total).....	96.0	95.6	(¹)	4.0	4.4	(¹)
Kilowatthours generated.....	95.9	95.4	95.1	4.1	4.6	4.9
Kilowatthours purchased.....	96.6	96.6	(¹)	3.4	3.4	(¹)
Number of street lamps:						
Arc.....	80.5	75.8	(¹)	19.5	24.2	(¹)
Incandescent and other varieties.....	69.6	69.6	(¹)	30.4	30.4	(¹)
Stationary motors served:						
Number.....	90.8	95.0	97.3	9.2	5.0	2.7
Horsepower capacity.....	95.4	96.0	98.1	4.6	4.0	1.9
Number of meters.....	86.9	87.0	87.2	13.1	13.0	12.8
Number of customers.....	85.4	86.3	85.4	13.6	13.7	14.6

¹ Figures not available.

TABLE 16.—Output and Disposal of Current.

	Central electric stations—Total output and disposal of current: 1917 and 1912.		
	Total.	Commercial.	Municipal.
Output:			
1917—			
Total.....	31,044,049,234	29,812,190,746	1,231,858,488
Kilowatthours generated.....	25,438,303,272	24,398,983,183	1,039,320,089
Kilowatthours purchased.....	5,605,745,962	5,413,207,563	192,538,399
1912—			
Total.....	14,182,612,490	13,556,505,383	626,107,107
Kilowatthours generated.....	11,569,109,885	11,031,583,155	537,526,730
Kilowatthours purchased.....	2,613,502,605	2,524,922,228	88,580,377
Per cent of total output:			
1917—			
Kilowatthours generated.....	81.9	81.8	84.4
Kilowatthours purchased.....	18.1	18.2	15.6
1912—			
Kilowatthours generated.....	81.6	81.4	85.8
Kilowatthours purchased.....	18.3	18.6	14.2
Disposal of current, 1917:			
For light.....	5,112,516,949	4,445,217,785	667,299,164
For power.....	13,174,827,277	12,833,191,106	341,636,171
To other public service corporations.....	7,464,620,574	7,444,108,488	20,512,086
Other purposes (nonrevenue).....	831,473,947	821,522,389	9,951,558
Distribution and line losses.....	4,460,610,487	4,268,150,978	192,459,509
Average per plant—			
For light.....	781,491	1,052,372	287,877
For power.....	2,013,884	3,038,161	147,384
To other public service corporations.....	1,141,030	1,762,336	8,849
Other purposes (nonrevenue).....	127,098	194,489	4,293
Distribution and line losses.....	681,842	1,010,452	83,028
Per cent of total output, 1917—			
For light.....	16.5	14.9	54.2
For power.....	42.4	43.0	27.7
To other public service corporations.....	24.0	25.0	1.7
Other purposes (nonrevenue).....	2.7	2.8	0.8
Distribution and line losses.....	14.4	14.3	15.6

TABLE 17.—Central Electric Stations, Grouped According to Population of Districts Served, Together with the Number of Kilowatthours Consumed for Light and Power Service: 1917.

Population group.	Num-ber of sta-tions.	Population of districts served.	Kilowatthours consumed for light.	Kilowatthours consumed for power.	Per cent distribution.			
					Num-ber.	Popu-lation.	Kilowatthour consumption.	
							Light.	Power.
Total.....	6,489	62,919,662	5,112,412,249	12,585,028,828	100.0	100.0	100.0	100.0
Under 1,000.....	2,221	1,185,760	52,083,623	269,892,135	34.2	1.9	1.0	2.1
1,000 but under 2,000.....	1,455	1,841,370	94,610,077	202,227,849	22.4	2.9	1.9	1.6
2,000 but under 5,000.....	1,363	3,740,683	218,893,205	354,403,358	21.0	5.9	4.3	2.8
5,000 but under 10,000.....	576	3,366,579	226,054,862	361,796,574	8.9	5.4	4.4	2.9
10,000 but under 25,000.....	408	5,111,742	346,885,079	1,332,081,698	6.3	8.1	6.8	10.6
25,000 but under 50,000.....	181	4,724,429	349,085,990	945,339,029	2.8	7.5	6.8	7.5
50,000 but under 100,000.....	100	4,731,522	345,429,519	1,270,413,675	1.5	7.5	6.8	10.1
100,000 but under 200,000.....	62	7,182,363	460,182,514	1,304,131,792	1.1	11.4	9.0	10.4
200,000 but under 500,000.....	51	9,935,538	811,360,518	2,134,976,626	0.8	15.8	15.9	17.0
500,000 and over.....	65	21,099,706	2,207,826,852	4,409,766,092	1.0	33.5	43.2	35.0
Commercial.....	4,171	56,459,723	4,445,113,085	12,244,392,657	100.0	100.0	100.0	100.0
Under 1,000.....	1,477	770,988	32,328,817	266,683,786	35.4	1.4	0.7	2.2
1,000 but under 2,000.....	830	1,061,322	52,154,089	191,390,836	19.9	1.9	1.2	1.6
2,000 but under 5,000.....	792	2,234,221	124,282,638	311,526,747	19.0	4.0	2.8	2.5
5,000 but under 10,000.....	352	2,176,865	130,391,618	316,354,394	8.4	3.9	2.9	2.6
10,000 but under 25,000.....	310	4,287,745	270,681,527	1,282,679,204	7.4	7.6	6.1	10.5
25,000 but under 50,000.....	154	4,323,114	307,636,232	922,898,973	3.7	7.7	6.9	7.5
50,000 but under 100,000.....	88	4,509,810	313,270,631	1,239,120,418	2.1	8.0	7.0	10.1
100,000 but under 200,000.....	63	6,669,430	426,866,425	1,271,658,136	1.5	11.8	9.6	10.4
200,000 but under 500,000.....	48	9,335,522	746,656,274	2,092,549,543	1.2	16.5	16.8	17.1
500,000 and over.....	57	21,099,706	2,040,844,834	4,349,530,620	1.4	37.3	45.9	35.5
Municipal.....	2,318	13,671,460	667,299,164	341,636,171	100.0	100.0	100.0	100.0
Under 1,000.....	744	423,786	19,754,806	3,208,349	32.1	3.1	3.0	0.9
1,000 but under 2,000.....	625	822,897	42,455,988	10,837,013	27.0	6.0	6.4	3.2
2,000 but under 5,000.....	571	1,643,319	94,610,567	42,876,611	24.6	12.0	14.2	12.5
5,000 but under 10,000.....	224	1,415,297	95,663,244	45,442,180	9.7	10.4	14.3	13.3
10,000 but under 25,000.....	98	1,344,354	76,203,552	49,402,494	4.2	9.8	11.4	14.5
25,000 but under 50,000.....	27	934,460	41,449,758	23,440,056	1.2	6.8	6.2	6.9
50,000 but under 100,000.....	12	713,191	32,158,888	31,293,257	0.5	5.2	4.8	9.2
100,000 but under 200,000.....	6	775,216	33,316,089	32,473,656	0.3	5.7	5.0	9.5
200,000 but under 500,000.....	3	850,000	64,704,244	42,427,083	0.1	6.2	9.7	12.4
500,000 and over.....	8	4,748,940	166,982,028	60,235,472	0.3	34.7	25.0	17.6

APPENDIX 3.

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